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Environmental Releases for Calendar Year 1996

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Project Hanford Management Contractor for the
U.S. Department of Energy under Contract DE-AC06-96RL13200

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B. P. Gleckler

Date Published
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ENVIRONMENTAL RELEASES FOR CALENDAR YEAR 1996

ABSTRACT

This report presents data on radioactive and nonradioactive materials released into the environment during calendar year 1996 from facilities and activities managed by the Fluor Daniel Hanford, Incorporated (formerly the Westinghouse Hanford Company) and Bechtel Hanford, Incorporated. Fluor Daniel Hanford, Incorporated provides effluent monitoring services for Bechtel Hanford, Incorporated, which includes release reporting. Both summary and detailed presentations of the environmental releases are provided. When appropriate, comparisons to data from previous years are made.

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EXECUTIVE SUMMARY

This report fulfills the annual environmental release reporting requirements of U.S. Department of Energy (DOE) Orders 5484.1* and 5400.1.** This report provides supplemental information to the Hanford Site Environmental Report. The Hanford Site Environmental Report provides an update on the environmental status of the entire Hanford Site. The sitewide annual report summarizes the degree of compliance of the Hanford Site with applicable environmental regulations and informs the public about the impact of Hanford operations on the surrounding environment.

Like the Hanford Site Environmental Report, this annual report presents a summary of the environmental releases from facilities and activities managed by Fluor Daniel Hanford, Incorporated (FDH) and Bechtel Hanford, Incorporated (BHI). In addition to the summary data, this report also includes detailed data on air emissions, liquid effluents, and hazardous substances released to the environment during calendar year 1996 from these facilities.

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*DOE, 1990, *Environmental Protection, Safety, and Health Protection Information Reporting Requirements*, DOE Order 5484.1, Change 7, U.S. Department of Energy, Washington, D.C.

**DOE, 1990, *General Environmental Protection Program*, DOE Order 5400.1, Change 1, U.S. Department of Energy, Washington, D.C.

As part of this executive summary, comprehensive data summaries of air emissions and liquid effluents in 1996 are displayed in Tables ES-1 through ES-5. These tables represent the following:

- **Table ES-1.** Radionuclide air emissions data (detailed data on emissions are presented in Section 2.0)
- **Table ES-2.** Data on radioactive liquid effluents discharged to the soil (detailed data on releases from individual waste streams to soil column disposal sites are presented in Section 3.0)
- **Table ES-3.** Radionuclides discharged to the Columbia River (detailed data are shown in Section 3.0)
- **Table ES-4.** Nonradioactive air emissions data (detailed information is given in Section 2.0)
- **Table ES-5.** Total Volumes and Flow Rates of 200/600 Area Radioactive Liquid Effluents (detailed data are presented in Section 3.0).

Table ES-1

Release Estimates of 1996 Radionuclide Air Emissions from FDH and BHI Facilities.	
Radionuclide	**Release (Ci)[a]**
^{3}H	3.6 E+00
^{60}Co	5.1 E-07
^{90}Sr	4.5 E-04
^{106}Ru	6.4 E-07
^{113}Sn	ND
^{125}Sb	2.2 E-06
^{129}I	3.9 E-03
^{134}Cs	1.6 E-08
^{137}Cs	6.1 E-04
^{154}Eu	4.5 E-07
^{155}Eu	1.9 E-07
^{238}Pu	4.9 E-06
$^{239,240}Pu$	2.5 E-04
^{241}Pu	4.1 E-04
^{241}Am	4.8 E-05

a 1 Ci = 3.7 E+10 Becquerel; ND = not detected (i.e. either the radionuclide was not detected in any sample during the year, or the average of all the measurements for that given radionuclide or type of radioactivity made during the year was below background levels).

Table ES-2

Release Estimates of 1996 Radioactive Liquid Effluents Discharged to Soil from FDH and BHI Facilities.

Radionuclide	Release (Ci)[a]
^{3}H	2.2 E+02
^{14}C	8.5 E-05
^{90}Sr	1.5 E-04
^{99}Tc	1.5 E-04
^{106}Ru	ND
^{113}Sn	ND
^{125}Sb	ND
^{134}Cs	ND
^{137}Cs	6.7 E-06
^{152}Eu	ND
^{154}Eu	ND
^{155}Eu	ND
^{234}U	2.0 E-04
^{235}U	ND
^{238}U	1.5 E-04
^{238}Pu	2.4 E-05
$^{239,240}Pu$	2.6 E-05
^{241}Am	9.3 E-05

a 1 Ci = 3.7 E+10 Becquerel; ND = Not Detected.

Table ES-3

Release Estimates of 1996 Radionuclides in Liquid Effluents Discharged to the Columbia River from FDH and BHI Facilities.

Radionuclide	Release (Ci)[a]
^{3}H	1.3 E-01
^{60}Co	2.3 E-03
^{90}Sr	1.2 E-01
^{106}Ru	ND
^{125}Sb	3.5 E-03
^{134}Cs	ND
^{137}Cs	3.8 E-03
^{154}Eu	ND
^{155}Eu	1.2 E-03
^{238}Pu	4.0 E-05
$^{239/240}Pu$	ND
^{241}Am	1.1E-04

a 1 Ci = 3.7 E+10 Becquerel; ND = Not Detected.

Table ES-4

Release Estimates of 1996 Nonradioactive Constituents in Air Emissions from FDH and BHI Facilities.	
Constituent	Quantities (kg)
Particulates	1.41 E+04
Sulfur oxides (SO_x)	4.14 E+05
Nitrogen oxides (NO_x)	2.27 E+05
Carbon monoxide (CO)	7.15 E+04
Lead	1.95 E+02
Volatile Organic Compounds	1.73 E+03
Ammonia	1.04 E+04
Arsenic	1.98 E+02
Beryllium	2.55 E+01
Cadmium	3.91 E+01
Carbon tetrachloride	9.07 E-01
Chromium	5.52 E+02
Cobalt	1.40 E+01
Copper	3.70 E+02
Formaldehyde	1.23 E+02
Manganese	7.51 E+02
Mercury	9.18 E+00
Nickel	7.10 E+02
Polycyclic organic matter	6.67 E+03
Selenium	7.14 E+01
Vanadium	3.95 E+02

Table ES-5

Total Volumes and Flow Rates of Radioactive Liquid Effluents Discharged to the 200/600 Area Disposal Sites during 1995 and 1996 from FDH and BHI Facilities[a].

Stream Code	EDP Code	Effluent Source	Disposal Site	Volume (L)		Flow Rate (gpm)	
				1995	1996	1995	1996
207-SL	H101	222-S Laboratory Chemical Sewer	216-S-26 Crib	2.4 E+06	0.0	2.8	0
207-U	H102	UO_3 Plant Waste Water	216-U-14 Ditch	0.0	0.0	0	0
2904-ZA	H103	PFP Cooling Water	216-Z-20 Crib	7.3 E+06	0.0	9.2	0
ACW	H108	242-A Evaporator Cooling Water	216-B-3 Pond	7.8 E+08	2.2 E+09	1175	8220
ASC	H110	242-A Evaporator Steam Condensate	216-B-3 Pond	2.3 E+07	8.4 E+06	22.9	12.3
CA8	H115	241-A Tank Farm Cooling Water	216-B-3 Pond	8.3 E+08	8.6 E+08	414	432
CAR	H116	244-AR Vault Cooling Water	216-B-3 Pond	4.8 E+06	2.0 E+06	2	1
CBC	H117	B Plant Cooling Water	216-B-3 Pond	3.0 E+09	2.1 E+09	1491	1035
CSL	H118	PUREX Chemical Sewer	216-B-3 Pond	1.8 E+08	0.0	230	0
CWL	H119	PUREX Cooling Water	216-B-3 Pond	0.0	0.0	0	0
LWC	H120	Laundry Waste Water	216-W-LC Crib	0.0	0.0	0	0
U-17	H126	UO_3Plant Process Condensate	216-U-17 Crib	0.0	0.0	0	0
ETF	H129	Effluent Treatment Facility	616-A Crib	0.0	3.1 E+07[b]	0	265

a These discharges do not include discharges to the 200 East Area Treated Effluent Disposal Facility, since discharges from this facility meet drinking water standards.

b This value includes discharges from the last two weeks of 1995, when the Effluent Treatment Facility first started operating.

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LIST OF TERMS

BHI	Bechtel Hanford, Incorporated
CERCLA	Comprehensive Environmental Response, Compensation, *and Liability Act of 1980*
CFR	Code of Federal Regulations
DCG	derived concentration guide
DOE	U.S. Department of Energy
Ecology	State of Washington Department of Ecology
EDE	effective dose equivalent
EDP Code	Electronic Data Processing Code
EP	external publication
EPA	U.S. Environmental Protection Agency
ERDF	Environmental Restoration Disposal Facility
FDH	Fluor Daniel Hanford, Incorporated
FFTF	Fast Flux Test Facility
HEPA	high-efficiency particulate air (filter)
LWDF	Liquid Waste Disposal Facility
MASF	Maintenance and Storage Facility
MEI	maximally exposed individual
mrem	millirem (unit of dose)
ND	not detected
NPDES	National Pollutant Discharge Elimination System
PHMC	Project Hanford Management Contract
PFP	Plutonium Finishing Plant
PSD	Prevention of Significant Deterioration
PNNL	Pacific Northwest National Laboratory
POTW	publicly owned treatment works (City of Richland)
ppm	parts per million
PUREX	Plutonium-Uranium Extraction
RCRA	Resource Conservation and Recovery Act of 1976
REDOX	Reduction-Oxidation
RL	U.S. Department of Energy, Richland Operations Office
RQ	reportable quantity
SALDS	State-Approved Land Disposal Structure
TEDF	Treated Effluent Disposal Facility
TRIGA	Test Reactor and Isotope Production, General Atomics
TRU	transuranic (waste)
TRUSAF	Transuranic Waste Storage and Assay Facility
UO_3	uranium trioxide
WAC	Washington Administrative Code
WESF	Waste Encapsulation Storage Facility

LIST OF TERMS (continued)

WDOH	State of Washington Department of Health
WHC	Westinghouse Hanford Company
WMH	Waste Management Federal Services of Hanford, Incorporated
WSCF	Waste Sampling and Characterization Facility

ENVIRONMENTAL RELEASES FOR CALENDAR YEAR 1996

1.0 INTRODUCTION

Fluor Daniel Hanford, Incorporated (FDH) and Bechtel Hanford, Incorporated (BHI) are responsible for monitoring radioactive and nonradioactive material released into the environment from DOE facilities at the Hanford Site. The Management & Operations contract held by the Westinghouse Hanford Company (WHC) is in closeout. October 1, 1996, Fluor Daniel Hanford, Incorporated accepted certain Westinghouse Hanford Company responsibilities under the Project Hanford Management Contract. Bechtel Hanford, Incorporated had contracted the services of WHC (now FDH) to perform some effluent monitoring duties, which includes fulfilling its annual effluent reporting requirements. This report documents the environmental releases from facilities and activities managed by FDH and BHI during calendar year 1996. The monitored facilities are located in the 100 Areas (reactor areas), 200 Areas (separations areas), 300 and 400 Areas (research and development areas), 1100 Area (warehouses, stores, and offices), and the 600 Area (all remaining areas of the Hanford Site).

1.1 PURPOSE

This report fulfills the annual environmental release reporting requirements of U.S. Department of Energy (DOE) Orders 5484.1 and 5400.1 (DOE 1990a and DOE 1990b). This report provides supplemental information to the Hanford Site Environmental Report for Calendar Year 1996 (PNNL 1997a). The Hanford Site Environmental Report provides an update on the environmental status of the entire Hanford Site. The sitewide annual report summarizes the degree of compliance of the Hanford Site with applicable environmental regulations and informs the public about the impact of Hanford operations on the surrounding environment.

Like the Hanford Site Environmental Report, this annual report presents a summary of the environmental releases from facilities managed by WHC and monitored by BHI. In addition to the summary data, this report also includes detailed data on air emissions, liquid effluents, and hazardous substances released to the environment from these facilities, during calendar year 1996.

1.2 SCOPE

This report presents information and data on liquid effluents, air emissions, and nonroutine hazardous substance releases that entered the environment in 1996 from facilities managed by FDH and monitored by BHI. When appropriate, comparisons are made to past releases.

1.3 TYPES AND LOCATIONS OF RELEASES

Radioactive liquid effluents and air emissions are released from facilities in the 100, 200, 300, and 400 Areas. Radioactive liquid effluents are discharged to the soil in the 200 Areas and to the Columbia River at the 100-N and 100-K Areas.

The major potential sources of nonradioactive air emissions of industrial origin are (1) fossil-fuel combustion emissions from powerhouse facilities and portable generators in the 200 and 300 Areas, (2) ammonia emissions from liquid radioactive waste tanks and the operation of the 242-A Evaporator, and (3) carbon tetrachloride emissions from passively vented wells and the CCl_4 Vapor Extraction Project.

Waste water from the powerhouse facilities and water treatment facilities in the 200 East Area is discharged to the soil column. Waste water from the powerhouse facilities and water treatment facilities in the 200 West Area is discharged to the 200 East Area Treated Effluent Disposal Facility (TEDF). In the 300 Areas, filter backwash from the water treatment plant is sent to the 300 Area TEDF for treatment and then discharged to the Columbia River, via a permitted outfall. The 100 N Sanitary Sewage Lagoon receives sanitary sewage waste water from the 100 N facilities and from failed septic systems, via tanker truck. 100 B, 100 D, 100 H, and 100 K Areas discharge sanitary waste water into the septic-tanks or drain-fields. Sanitary waste water is discharged to several septic-tank or subsurface disposal systems in the 200 Areas. Sanitary waste water was also discharged to a septic-tank trench system in the 300 Area and the sewage treatment plant and lagoon in the 400 Area. As of October 1, 1996, sanitary waste water from the 300 Area is being discharged to the City of Richland's publicly owned treatment works (POTW). In April of 1997, 400 Area sanitary waste water discharges started going to the Washington Public Power Supply's sewage treatment plant.

Nondangerous solid wastes generated at the Hanford Site have historically been buried near the 200 Areas in Hanford's Solid Waste Landfill. On March 29, 1996 this landfill was closed. Leachate from Hanford's closed Solid Waste Landfill is collected, transported, and treated at the 300 Area TEDF.

Beginning on December 29, 1995, nondangerous wasted have been disposed of at the Richland Landfill, which is located at the southern edge of the Hanford Site boundary. Since February 1996, medical wastes have been shipped to Waste Management of Kennewick and asbestos to Basin Disposal, Inc., in Pasco, and Hanford's Environmental Restoration Disposal Facility (ERDF). Starting in March of 1996, nonregulated containerized waste has been shipped to Waste Management of Kennewick.

1.4 ENVIRONMENTAL RELEASE LIMITS AND GUIDELINES

This section presents environmental release standards. Relevant limits and guidelines for nonradioactive constituents also are included in this section. Guidelines are applicable for nonradioactive constituents when they: (1) affect the release and transport of radioactive constituents, (2) are necessary to meet any issued Federal, State, or local permit, or (3) are necessary to meet any Federal, State, or local regulations or guidelines prescribed by the U.S. Department of Energy, Richland Operations Office (RL).

1.4.1 Limits for Radioactive Releases

Quantities of radionuclides in air emissions and liquid effluents from Hanford facilities are governed by DOE Order 5400.5, *Radiation Protection of the Public and the Environment* (DOE 1993a). Quantities of radionuclides in air emissions are regulated by Title 40 of the Code of Federal Regulations Part 61, Subpart H (EPA 1989) and the Washington Administrative Code (WAC) Chapter 246-247 (SOW 1994). The effective dose equivalent (EDE) received by any member of the offsite public from all effluents and emissions released during routine operations at the Hanford Site is not to exceed 100 mrem/yr from continuous exposure throughout a prolonged period (5 years) and 500 mrem/yr from noncontinuous, occasional exposure. From the air pathway only, the EDE to any member of the public is not to exceed 10 mrem/yr.

The derived concentration guide (DCG) values in DOE Order 5400.5 apply at the location of actual exposure to members of the public. DCG values are used for comparison purposes only.

The 300 Area TEDF is also regulated by an aquatic lands sewer outfall lease, number 20-012257, from the U.S. Department of Natural Resources.

The Pacific Northwest National Laboratory (PNNL), operated for DOE by Battelle Memorial Institute, issues the annual environmental summary report for the Hanford Site (PNNL 1997a) as required by DOE Order 5400.1. This report assesses the radiological impact to the public resulting from all Hanford Site operations, in accordance with DOE Order 5400.5 (DOE 1993a) and DOE Order 5480.1B (DOE 1993b). The PNNL report uses the release data contained in this report and the *Radionuclide Air Emissions Report for the Hanford Site Calendar Year 1996* (DOE-RL 1997) to calculate the offsite radiological dose impact. The PNNL report summarizes the information used to verify the Hanford Site's compliance with the dose standards specified in DOE Order 5400.5.

1.4.2 Limits for Nonradioactive Releases

The *Resource Conservation and Recovery Act of 1976* (RCRA), the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA), and the State of Washington's *Dangerous Waste Regulations*, WAC 173-303, also regulate nonradioactive constituents in air emissions and liquid effluents. Releases and spills of waste materials are reported immediately to appropriate Federal, State, and local agencies when required by CERCLA, RCRA, or WAC 173-303-145. Reporting to the National Response Center is required under CERCLA when the released or spilled material exceeds the reportable quantities listed in 40 CFR 302. Reporting to Ecology is required when a dangerous waste or hazardous substance is spilled or released into the environment, such that human health or the environment is threatened, regardless of quantity, as defined in WAC 173-303-145.

Liquid effluent streams discharging to the Columbia River are regulated by the National Pollutant Discharge Elimination System. Limits for specific constituents are specified in the permit from the U.S. Environmental Protection Agency (EPA).

Several liquid effluent streams discharging to the soil column are permitted by Ecology. Limits for specific constituents are specified in the permit from State of Washington Department of Ecology (Ecology).

2.0 AIR EMISSIONS

Both radioactive and nonradioactive air emissions have been released to the atmosphere from facilities and activities managed by FDH and BHI. Release data for each type of emission are discussed separately.

2.1 RADIONUCLIDE AIR EMISSIONS

Radionuclide air emissions from actively ventilated point sources, with a potential to emit radioactive material to the atmosphere, are routinely monitored. Air emissions from actively ventilated point sources are usually discharged from stacks or vents. In the 200 Areas, stacks and vents are designated by a number that has a "291" or "296" prefix, depending on their height. Stacks and vents in the 200 Areas that are 61 m (200 ft) tall are designated by a "291" prefix. All other stacks and vents are designated by the "296" prefix. In the 100, 300, and 400 Areas, stacks and vents usually are identified by facility names.

During 1996, 94 actively ventilated point sources were monitored by FDH and BHI. Information on all of these point sources are included in this report.

Radionuclide air emissions from sources other than actively ventilated point sources are monitored as diffuse and fugitive emissions. These sources are monitored collectively by the Near-Facility Monitoring Program and the Environmental Surveillance Program. Monitoring data from these sources is not presented in this report but can be obtained from the *Radionuclide Air Emission Report for the Hanford Site Calendar Year 1997* (DOE-RL 1997), the *Hanford Site Near-Facility Environmental Monitoring Annual Report Calendar Year 1996* (WNW 1997), the *Hanford Site Environmental Monitoring Report for Calendar Year 1995* (PNNL 1997a), and *1996 Surface Environmental Surveillance Data* (PNNL 1997b).

2.1.1 Filtration of Radionuclide Air Emissions

The following are examples of methods used to remove radionuclides from air emissions: (1) high-efficiency particulate air (HEPA) filters, (2) sand filters, (3) charcoal absorbers (for iodine removal), (4) water scrubbers, (5) deep-bed fiberglass filters, (6) and fiberglass prefilters. Generally at least one stage, and often several stages, of HEPA filtration is used as the final particulate removal method before the air is discharged to the atmosphere. All in-place HEPA filters are required to have an efficiency of 99.95% in removing airborne particles with a median aerodynamic equivalent diameter of 0.3 μm. Filter efficiency is routinely tested. Past release data have shown that radionuclide concentrations in many emissions are below the lower limit of analytical detection.

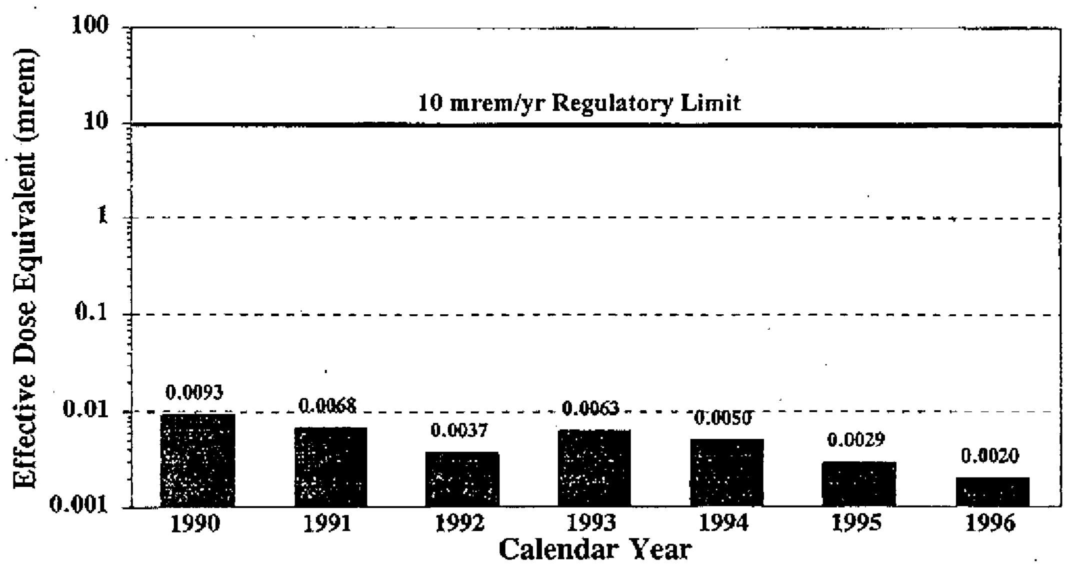
2.1.2 Radionuclide Air Emissions Data

Release data on radionuclide air emissions from facilities, by area, are presented in Table 2-1. Tables 2-2 and 2-3 present data on the radionuclide air emissions from individual stacks and vents. The data consist of radionuclides detected or sampled for, average concentrations, and total activities.

Actively ventilated point source emissions are reported in this document when the following criteria were met during 1996: (1) point source required continuous monitoring or periodic confirmatory measurements by 40 CFR 61 Subpart H or WAC 246-247, (2) point source was registered with Washington State Department of Health (WDOH), (3) the point source normally had radionuclide emissions or potentially had radionuclide emissions. Point sources not included in this section did not meet the previous criteria or their air emissions were not forcibly discharged (e.g. passively ventilated, sealed off, deactivated, etc...). Air emissions forcibly discharged (actively ventilated) by exhaust fans are sampled only if radioactive material could be potentially released.

Radionuclide air emissions from all of the Hanford Site's actively ventilated point sources, including PNNL sources, resulted in an offsite dose to the maximally exposed individual (MEI) of 2.0 E-03 mrem (2.0 E-05 mSv) EDE (see Figure 2-1)(DOE-RL 1997). This dose is well below the 10 mrem/yr EDE standards imposed by EPA on radionuclide air emissions (40 CFR 61 Subpart H).

Figure 2-1
Historical 40 CFR 61, Subpart H Doses to the MEI[a]



a These doses include emissions from PNNL facilities. This figure was obtained from DOE/RL-97-43 (DOE-RL 1997).

The radionuclides released from the 100 Areas contributing the most to the MEI's dose include ^{137}Cs, $^{239/240}$Pu, and ^{241}Am. In the 100 Areas, radionuclide emissions at 100-N Area remained below those reported when N Reactor operated, and the 100-K Area emissions did not change significantly from 1995. In the 200 Areas, radionuclides contributing the most to the MEI's dose were ^{129}I, ^{137}Cs, $^{239/240}$Pu, and ^{241}Am. 200 Area emissions have not changed significantly from 1995 emissions. Significant dose contributing radionuclides released from the 300 and 400 Areas included ^{3}H and $^{239/240}$Pu. Releases from the 300 and 400 Area facilities did not vary substantially from those reported for 1995 (DOE-RL 1996).

2.2 NONRADIOACTIVE AIR EMISSIONS

In 1996, the nonradioactive air emissions were discharged from the following facilities: (1) 284-E powerhouse, (2) 284-WB oil fired package boiler, (3) the 300 Area powerhouse, (4) East Tank Farms & 242-A Evaporator Operations, (5) West Tank Farms Operations, and (6) the 200 West Area CCl_4 Vapor Extraction Project. Data on emissions from these sources are shown in Tables 2-4 and 4-1. Powerhouse stack emissions were based on the quantity and type of fuel consumed, using formulas established by the EPA (EPA 1990a). Table 2-5 contains of summary of fuel consumption by the powerhouses.

Fabric-filter collection systems, called baghouses, remove particulate matter emitted from coal-fired boilers. Baghouses are installed at the coal-fired boilers in the 200 Area's Powerhouses 284-E and 284-W. The 284-W Powerhouse's baghouses were shutdown in February 1995. Anytime a baghouse is bypassed (usually because of unavoidable replacement, repair, and maintenance of equipment), RL and the Washington Department of Ecology are notified through a monthly report of excess emissions.

Table 2-1

Release Estimates of 1996 Radionuclide Air Emissions from FDH and BHI Facilities.						
	Release, Ci[a]					
Radionuclide	100 Areas	200 East Area	200 West Area	300 Area	400 Area	Total
^{3}H (as HTO)	NM	NM	NM	NM	3.6 E+00	3.6 E+00
^{60}Co	5.1 E-07	7.7 E-10	ND	NM	NM	5.1 E-07
^{65}Zn	ND	ND	ND	NM	NM	ND
^{90}Sr	2.9 E-05[b]	6.2 E-05[b]	3.6 E-04[b]	7.5 E-07[b]	NM	4.5 E-04[b]
^{95}Zr	ND	ND	ND	NM	NM	ND
^{106}Ru	5.4 E-07	9.5 E-08	NM	NM	NM	6.4 E-07
^{113}Sn	ND	ND	NM	NM	NM	ND
^{125}Sb	1.9 E-07	2.0 E-06	NM	NM	NM	2.2 E-06
^{129}I	NM	3.9 E-03	NM	NM	NM	3.9 E-03
^{131}I	NM	ND	NM	ND	ND	ND
^{134}Cs	1.3 E-08	3.0 E-09	ND	NM	NM	1.6 E-08
^{137}Cs	5.1 E-05	5.5 E-04	6.5 E-07	ND	5.5 E-06[c]	6.1 E-04[c]
^{152}Eu	ND	ND	ND	NM	NM	ND
^{154}Eu	4.5 E-07	ND	ND	NM	NM	4.5 E-07
^{155}Eu	1.9 E-07	ND	ND	NM	NM	1.9 E-07
Uranium, depleted[d]	NM	NM	NM	ND[d]	NM	ND
^{238}Pu	5.2 E-07	2.2 E-07	4.2 E-06	ND	NM	4.9 E-06
$^{239,240}Pu$	4.5 E-06[e]	6.7 E-06[e]	2.4 E-04[e]	6.8 E-08[e]	8.3 E-07[e]	2.5 E-04[e]
^{241}Pu	4.1 E-05	1.7 E-05	3.5 E-04	NM	NM	4.1 E-04
^{241}Am	2.0 E-06	9.2 E-06	3.7 E-05	ND	NM	4.8 E-05

Notes:

a 1 Ci = 3.7 E+10 Becquerel; ND = not detected (i.e. either the radionuclide was not detected in any sample during the year, or the average of all the measurements for that given radionuclide or type of radioactivity made during the year was below background levels); NM = not measured.

b This value includes total beta release data. Total beta results assumed to be ^{90}Sr for dose calculations.

c This value includes total beta release data. Total beta results assumed to be ^{137}Cs for dose calculations from FFTF emissions.

d Determined from total alpha measurements. Assumed to be depleted uranium consisting of 63.478 Ci% ^{238}U, 0.821 Ci% ^{235}U, and 35.701 Ci% ^{234}U (99.797 Wt% ^{238}U, 0.200 Wt% ^{235}U, and 0.003 Wt% ^{234}U).

e This value includes total alpha release data. Total alpha results assumed to be $^{239/240}Pu$ for dose calculations.

Figure 2-2
Historical Airborne Effluent Releases of $^{239/240}Pu$

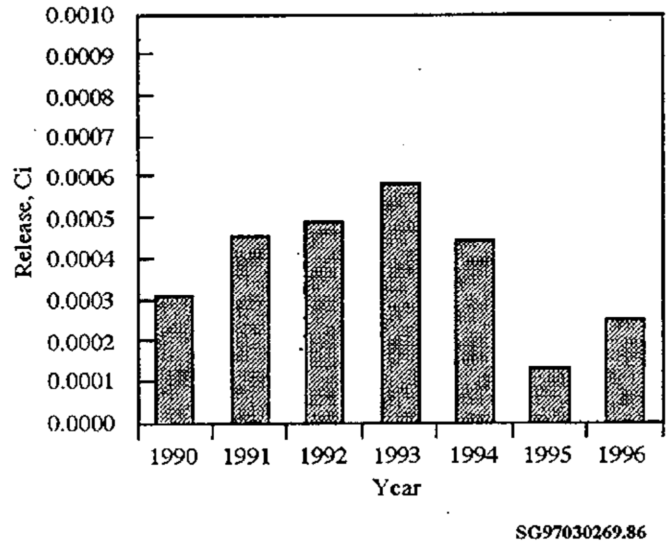


Figure 2-3
Historical Airborne Effluent Releases of ^{129}I

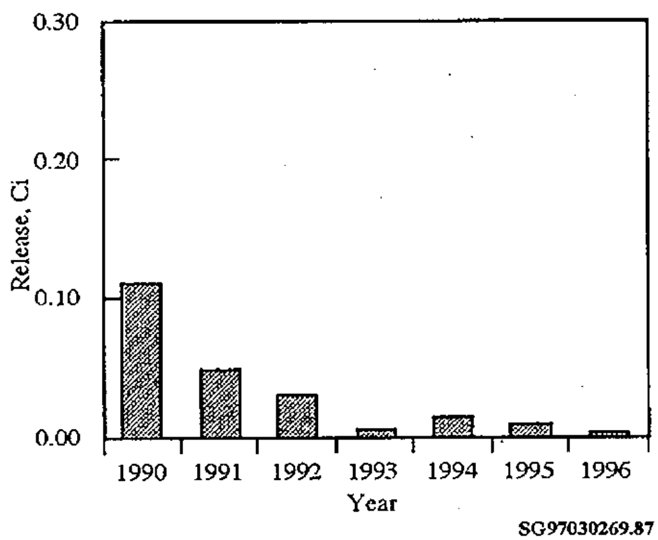


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Table 2-2 (4 sheets)

1996 Hanford Site Radionuclide Air Emissions Data for Major Point Sources from FDH and BHI Facilities. (major point sources have the potential of >0.1 mrem/y EDE to nearest offsite resident)[a]						
Source ID[b] (Facility/Contractor) [EDP Codes]	Discharge Height (m)	Emission Control[c] (stages)	Total Flow (m^3)	Radionuclide[d]	Average Concentration (µCi/mL)[e]	Annual Emissions (Ci)[e]
200 East Area Point Sources						
291-A-1 (PUREX/FDH) [A552,A511,A007]	61.0	HEPA (3)	1.4 E+09	^{90}Sr	1.7 E-14	2.4 E-05
				^{106}Ru	ND	ND
				^{113}Sn	ND	ND
				^{125}Sb	8.0 E-16	1.9 E-06
				^{129}I	2.5 E-12	3.6 E-03
				^{134}Cs	ND	ND
				^{137}Cs	6.7 E-14	7.9 E-05
				^{238}Pu	1.2 E-16	1.7 E-07
				• $^{239,240}Pu$	1.9 E-15	2.8 E-06
				^{241}Pu	9.8 E-15	1.4 E-05
				• ^{241}Am	6.2 E-15	8.8 E-06
				total alpha	6.0 E-15	8.6 E-06
				total beta	6.2 E-14	8.7 E-05
296-A-1 (PUREX/FDH) [A540]	20.7	HEPA (3)	4.4 E+07	^{238}Pu	8.4 E-16	3.7 E-08
				• $^{239,240}Pu$	1.8 E-14	8.1 E-07
				^{241}Pu	7.1 E-14	3.1 E-06
				• ^{241}Am	6.2 E-15	2.7 E-07
				total alpha	1.4 E-14	6.1 E-07
				total beta	3.0 E-15	1.3 E-07
291-B-1 (B Plant/FDH) [B691]	61.0	HEPA (2)	5.4 E+08	^{90}Sr	3.3 E-14	1.8 E-05
				^{134}Cs	ND	ND
				• ^{137}Cs	6.7 E-13	3.7 E-04
				^{238}Pu	1.3 E-17	7.2 E-09
				• $^{239,240}Pu$	2.6 E-15	1.4 E-06
				^{241}Am	1.8 E-16	9.8 E-08
				total alpha	3.3 E-15	1.8 E-06
				total beta	4.4 E-13	2.4 E-04
296-A-22 (242-A Evaporator/FDH) [E643,E002]	18.6	HEPA (2)	7.7 E+06	^{60}Co	1.0 E-16	7.7 E-10
				^{90}Sr	6.2 E-16	4.8 E-09
				• ^{106}Ru	1.0 E-14	7.9 E-08
				^{113}Sn	ND	ND
				^{125}Sb	ND	ND
				^{129}I	6.2 E-14	4.8 E-07
				^{134}Cs	ND	ND
				• ^{137}Cs	1.4 E-15	9.7 E-09
				^{238}Pu	ND	ND
				$^{239,240}Pu$	3.3 E-17	2.6 E-10
				^{241}Am	8.6 E-17	6.6 E-10
				total alpha	1.5 E-16	1.2 E-09
				total beta	2.9 E-15	2.3 E-08
296-A-12 (East Tank Farms/FDH) [E058]	45.7	HEPA (2)	0.0 E+00	• ^{90}Sr	(did not operate)	

Table 2-2 (4 sheets)

1996 Hanford Site Radionuclide Air Emissions Data for Major Point Sources from FDH and BHI Facilities.
(major point sources have the potential of >0.1 mrem/y EDE to nearest offsite resident)[a]

Source ID[b] (Facility/Contractor) [EDP Codes]	Discharge Height (m)	Emission Control[c] (stages)	Total Flow (m^3)	Radionuclide[d]	Average Concentration (μCi/mL)[e]	Annual Emissions (Ci)[e]
296-A-17 296-P-26 (backup) (East Tank Farms/FDH) [E059,E026,E027] [E039,E040,E041]	15.2	HEPA (2)	5.0 E+07	^{90}Sr	1.0 E-13	4.4 E-06
				^{106}Ru	ND	ND
				^{113}Sn	ND	ND
				^{125}Sb	ND	ND
				^{129}I	5.5 E-12	2.4 E-04
				^{134}Cs	6.9 E-17	3.0 E-09
				• ^{137}Cs	2.5 E-12	9.6 E-05
				^{238}Pu	5.9 E-17	2.6 E-09
				^{239,240}Pu	2.4 E-16	8.5 E-09
				^{241}Am	2.3 E-16	8.2 E-09
				total alpha	4.2 E-15	1.9 E-07
				total beta	8.6 E-13	3.8 E-05
296-A-25 (East Tank Farms/FDH) [E080]	3.0	HEPA (2)	2.2 E+06	^{90}Sr	1.5 E-15	3.3 E-09
				^{134}Cs	ND	ND
				^{137}Cs	1.5 E-13	3.3 E-07
				^{238}Pu	6.0 E-18	1.3 E-11
				^{239,240}Pu	ND	ND
				^{241}Am	5.8 E-17	1.3 E-10
				total alpha	2.7 E-16	5.9 E-10
				total beta	1.4 E-13	2.9 E-07
296-B-28 (West Tank Farms/FDH) [E886]	3.4	HEPA (2)	3.0 E+06	^{90}Sr	ND	ND
				^{134}Cs	ND	ND
				• ^{137}Cs	2.8 E-16	8.2 E-10
				^{238}Pu	ND	ND
				• ^{239,240}Pu	1.8 E-17	5.5 E-11
				• ^{241}Am	3.8 E-17	1.1 E-10
				total alpha	7.4 E-16	2.3 E-09
				total beta	5.3 E-15	1.6 E-08
296-C-5 (East Tank Farms/FDH) [E069]	14.6	HEPA (2)	4.6 E+07	• ^{90}Sr	4.0 E-15	1.9 E-07
				^{134}Cs	ND	ND
				^{137}Cs	5.5 E-15	2.5 E-07
				^{238}Pu	ND	ND
				^{239,240}Pu	1.1 E-17	5.1 E-10
				• ^{241}Am	4.3 E-17	2.0 E-09
				total alpha	4.3 E-16	2.0 E-08
				total beta	2.3 E-14	1.0 E-06
296-P-16 (East Tank Farms/FDH) [E068]	4.6	HEPA (2)	4.9 E+07	• ^{90}Sr	2.9 E-15	1.4 E-07
				^{134}Cs	ND	ND
				^{137}Cs	1.4 E-14	6.7 E-07
				^{238}Pu	8.5 E-18	4.2 E-10
				• ^{239,240}Pu	7.4 E-17	3.6 E-09
				^{241}Am	5.8 E-17	2.8 E-09
				total alpha	1.2 E-16	5.8 E-09
				total beta	1.6 E-14	8.4 E-07

Table 2-2 (4 sheets)

1996 Hanford Site Radionuclide Air Emissions Data for Major Point Sources from FDH and BHI Facilities.
(major point sources have the potential of >0.1 mrem/y EDE to nearest offsite resident)[a]

Source ID[b] (Facility/Contractor) [EDP Codes]	Discharge Height (m)	Emission Control[c] (stages)	Total Flow (m^3)	Radionuclide[d]	Average Concentration (μCi/mL)[e]	Annual Emissions (Ci)[e]
200 West Area Point Sources						
291-Z-1 (PFP/FDH) [Z810]	61.0	HEPA (1-3)	4.3 E+09	^{137}Cs	1.2 E-16	5.2 E-07
				^{238}Pu	9.6 E-16	4.2 E-06
				• ^{239,240}Pu	4.0 E-14	1.7 E-04
				^{241}Pu	8.1 E-14	3.5 E-04
				• ^{241}Am	8.6 E-15	3.7 E-05
				total alpha	4.1 E-14	1.8 E-04
				total beta	3.8 E-15	1.7 E-05
296-S-22 (West Tank Farms/FDH) [W880]	3.7	HEPA (2)	2.2 E+06	• ^{90}Sr	ND	ND
				^{134}Cs	ND	ND
				• ^{137}Cs	1.2 E-16	2.6 E-10
				^{238}Pu	ND	ND
				^{239,240}Pu	3.5 E-17	7.7 E-11
				• ^{241}Am	2.4 E-17	5.2 E-11
				total alpha	2.4 E-16	5.0 E-10
				total beta	3.2 E-15	7.0 E-09
296-T-18 (West Tank Farms/FDH) [W882]	3.7	HEPA (2)	4.3 E+06	^{90}Sr	ND	ND
				^{134}Cs	ND	ND
				• ^{137}Cs	1.6 E-15	6.7 E-09
				^{238}Pu	2.1 E-18	9.2 E-12
				• ^{239,240}Pu	5.1 E-17	2.2 E-10
				• ^{241}Am	5.4 E-17	2.3 E-10
				total alpha	5.1 E-16	2.2 E-09
				total beta	5.0 E-15	2.2 E-08
300 Area Point Sources						
340-NT-EX (340 Waste Handling/FDH) [F002,F007]	5.5	HEPA (2)	2.6 E+07	^{131}I	ND	ND
				^{137}Cs	ND	ND
				^{238}Pu	ND	ND
				• ^{239,240}Pu	ND	ND
				^{241}Am	ND	ND
				total alpha	3.2 E-16	6.2 E-09
				total beta	9.9 E-16	2.2 E-08
EP-324-01-S (324 Bldg./FDH) [F025,F028]	48.0	HEPA (2)	1.1 E+09	^{3}H (as HTO)[g]	5.2 E-11	5.7 E-02
				^{3}H (as HT)[g]	2.9 E-10	3.2 E-01
				• ^{90}Sr	9.1 E-17	1.0 E-07
				• ^{137}Cs	2.3 E-15	2.5 E-06
				^{238}Pu	1.1 E-17	1.2 E-08
				^{241}Am	2.2 E-17	2.4 E-08
				total alpha	3.9 E-17	4.3 E-08
				total beta	2.6 E-15	2.9 E-06

Table 2-2 (4 sheets)

1996 Hanford Site Radionuclide Air Emissions Data for Major Point Sources from FDH and BHI Facilities.
(major point sources have the potential of >0.1 mrem/y EDE to nearest offsite resident)[a]

Source ID[b] (Facility/Contractor) [EDP Codes]	Discharge Height (m)	Emission Control[c] (stages)	Total Flow (m^3)	Radionuclide[d]	Average Concentration (μCi/mL)[e]	Annual Emissions (Ci)[e]
EP-327-01-S (327 Bldg./FDH) [F026,F029]	14.0	HEPA (2)	7.4 E+08	^{3}H (as HTO)[f]	1.5 E-10	1.1 E-01
				^{3}H (as HT)[f]	2.0 E-11	1.5 E-02
				• ^{90}Sr	2.8 E-16	2.1 E-07
				^{137}Cs	1.0 E-15	7.7 E-07
				^{220}Rn[h]	7.3 E-08	5.4 E+01
				^{222}Rn[h]	6.8 E-10	5.0 E-01
				• ^{238}Pu	7.3 E-18	5.4 E-09
				• ^{239,240}Pu	1.3 E-17	9.4 E-09
				^{241}Am	1.8 E-17	1.3 E-08
				total alpha	2.5 E-16	1.8 E-07
				total beta	3.3 E-15	2.5 E-06
EP-327-02-V (327 Decon. Cell/FDH) [F027]	9.0	HEPA (2)	1.1 E+07	• ^{90}Sr	2.6 E-17	2.9 E-10
				^{137}Cs	6.1 E-17	6.7 E-10
				• ^{238}Pu	4.9 E-18	5.4 E-11
				• ^{239,240}Pu	3.0 E-18	3.3 E-11
				^{241}Am	1.5 E-17	1.6 E-10
				total alpha	5.6 E-17	6.1 E-10
				total beta	8.3 E-16	9.1 E-09

Notes:

a Determining the state of National Emission Standards for Hazardous Air Pollutants (NESHAP) Subpart H compliance for each point source involved using nearest offsite residences, which differed from the MEI.

b ID = Identification, i.e., the alpha-numeric designator for the respective point source; FDH = Fluor Daniel Hanford, Inc.; BHI = Bechtel Hanford, Inc.

c Efficiencies are: ≥99.95% for HEPA; ≥95% for charcoal; ≥99.8% for sand filter; 0% for no emission control.

d Bullets, "•", identify specific radionuclide sampling and analysis required by 40 CFR 61 Subpart H.

e 1 μCi/mL = 3.7 E+10 Bq/m^3; 1 Curie = 3.7 E+10 becquerel; ND = not detected (i.e. either the radionuclide was not detected in any sample during the year, or the average of all the measurements for that given radionuclide or type of radioactivity made during the year was below background levels).

f HTO is tritium as condensable water vapor; HT is tritium as incondensable gas.

Table 2-3 (8 sheets)

1996 Hanford Site Radionuclide Air Emissions Data for Minor Point Sources from FDH and BHI.
(minor point sources have the potential of <0.1 mrem/y EDE to nearest offsite resident)

Source ID[a] (Facility/Contractor) [EDP Codes]	Discharge Height (m)	Emission Control[b]	Total Flow (m^3)	Radionuclide	Average Concentration (μCi/mL)[c]	Annual Emissions (Ci)[c]
100 Area Point Sources						
116-N (100 N Area/BHI) [Y211,Y212,Y213]	61.3	HEPA, charcoal	9.0 E+08	^{60}Co	ND	ND
				^{137}Cs	ND	ND
				total alpha	1.3 E-15	1.1 E-06
				total beta	9.3 E-15	8.3 E-06
105-N 14 ft (100 N Area/BHI) [Y259,Y260]	8.5	HEPA	0.0 E+00	total alpha	(did not operate)	
				total beta		
107-N (100 N Area/BHI) [Y265,Y266]	12.0	HEPA	1.1 E+08	^{60}Co	ND	ND
				^{137}Cs	ND	ND
				total alpha	1.9 E-16	2.0 E-08
				total beta	9.7 E-16	1.1 E-07
105-KE Basin (100 K Area/FDH) [Y245-Y248]	12.8	none	6.2 E+08	^{60}Co	3.3 E-16	2.0 E-07
				^{90}Sr	2.9 E-14	1.7 E-05
				^{106}Ru	ND	ND
				^{125}Sb	2.3 E-16	1.4 E-07
				^{134}Cs	ND	ND
				^{137}Cs	6.8 E-14	4.2 E-05
				^{154}Eu	6.5 E-16	4.0 E-07
				^{155}Eu	5.5 E-16	3.4 E-07
				^{238}Pu	8.0 E-16	4.9 E-07
				$^{239/240}$Pu	5.1 E-15	3.1 E-06
				^{241}Pu	6.3 E-14	3.9 E-05
				^{241}Am	3.0 E-15	1.8 E-06
				total alpha	1.2 E-14	7.5 E-06
				total beta	1.6 E-13	1.0 E-04
105-KW Basin (100 K Area/FDH) [Y234-Y236]	12.8	none	5.6 E+08	^{60}Co	5.4 E-16	3.0 E-07
				^{90}Sr	4.0 E-15	2.2 E-06
				^{106}Ru	9.6 E-16	5.4 E-07
				^{125}Sb	7.7 E-17	4.4 E-08
				^{134}Cs	1.3 E-16	7.2 E-08
				^{137}Cs	1.6 E-14	9.1 E-06
				^{154}Eu	8.9 E-17	5.1 E-08
				^{155}Eu	ND	ND
				^{238}Pu	4.4 E-17	2.5 E-08
				$^{239/240}$Pu	3.0 E-16	1.7 E-07
				^{241}Pu	4.3 E-15	2.5 E-06
				^{241}Am	2.3 E-16	1.3 E-07
				total alpha	3.3 E-15	1.8 E-06
				total beta	4.4 E-14	2.5 E-05

Table 2-3 (8 sheets)

1996 Hanford Site Radionuclide Air Emissions Data for Minor Point Sources from FDH and BHI.

(minor point sources have the potential of <0.1 mrem/y EDE to nearest offsite resident)

Source ID[a] (Facility/Contractor) [EDP Codes]	Discharge Height (m)	Emission Control[b]	Total Flow (m^3)	Radionuclide	Average Concentration (μCi/mL)[c]	Annual Emissions (Ci)[c]
1706-KER -27 ft (100 K Area/FDH) [Y244]	0.9	HEPA	3.2 E+07	total alpha total beta	5.9 E-16 3.3 E-15	1.9 E-08 1.0 E-07
1706-KE (100 K Area/FDH) [Y243]	7.6	HEPA	1.5 E+08	total alpha total beta	3.0 E-16 1.3 E-15	4.6 E-08 2.0 E-07
200 East Area Point Sources						
296-A-2 (PUREX/FDH) [A542]	20.7	HEPA	5.6 E+07	total alpha total beta	ND 8.1 E-16	ND 4.5 E-08
296-A-3 (PUREX/FDH) [A543]	24.1	HEPA	4.4 E+07	total alpha total beta	1.2 E-16 2.5 E-15	5.2 E-09 1.1 E-07
296-A-5A 296-A-5B (PUREX/FDH) [A545,A546]	17.1	HEPA	1.2 E+08	total alpha total beta	1.3 E-14 2.6 E-15	1.6 E-06 3.1 E-07
296-A-6 (PUREX/FDH) [A547]	20.7	HEPA	1.5 E+08	total alpha total beta	ND 4.0 E-16	ND 6.0 E-08
296-A-7 (PUREX/FDH) [A548]	20.7	HEPA	1.7 E+08	total alpha total beta	ND 6.0 E-16	ND 1.0 E-07
296-A-8 (PUREX/FDH) [A549]	20.7	HEPA	1.9 E+08	total alpha total beta	ND 1.6 E-15	ND 3.1 E-07
296-A-10 (PUREX/FDH) [A550]	4.6	HEPA	6.4 E+07	total alpha total beta	3.0 E-16 2.1 E-15	1.9 E-08 1.3 E-07
296-A-14 (PUREX/FDH) [A544]	9.1	HEPA	6.9 E+06	total alpha total beta	ND ND	ND ND
296-A-24 (PUREX/FDH) [A539]	24.0	None	0.0 E+00	total alpha total beta	(did not operate)	
296-B-5 (B Plant/FDH) [B686]	3.7	HEPA	2.5 E+07	total alpha total beta	ND 5.5 E-15	ND 1.4 E-07

Table 2-3 (8 sheets)

1996 Hanford Site Radionuclide Air Emissions Data for Minor Point Sources from FDH and BHI.
(minor point sources have the potential of <0.1 mrem/y EDE to nearest offsite resident)

Source ID[a] (Facility/Contractor) [EDP Codes]	Discharge Height (m)	Emission Control[b]	Total Flow (m^3)	Radionuclide	Average Concentration (μCi/mL)[c]	Annual Emissions (Ci)[c]
296-B-10 (WESF/FDH) [B748]	22.9	HEPA	3.1 E+08	^{90}Sr	3.7 E-14	1.1 E-05
				^{134}Cs	ND	ND
				^{137}Cs	1.5 E-14	4.6 E-06
				^{238}Pu	3.4 E-18	1.1 E-09
				$^{239/240}$Pu	1.3 E-17	3.9 E-09
				^{241}Am	2.6 E-17	1.1 E-08
				total alpha	1.1 E-15	3.4 E-07
				total beta	7.4 E-14	2.3 E-05
296-B-13 (B Plant/FDH) [B690]	3.5	HEPA	1.1 E+07	total alpha	1.8 E-16	1.9 E-09
				total beta	2.9 E-15	3.1 E-08
296-A-13 (East Tank Farms/FDH) [E052]	38.1	HEPA	0.0 E+00	total alpha	(did not operate)	
				total beta		
296-A-18 (East Tank Farms/FDH) [E060]	4.6	HEPA	1.6 E+04	total alpha	ND	ND
				total beta	ND	ND
296-A-19 (East Tank Farms/FDH) [E061]	4.6	HEPA	1.7 E+04	total alpha	ND	ND
				total beta	ND	ND
296-A-20 (East Tank Farms/FDH) [E197]	7.3	HEPA	6.4 E+04	total alpha	ND	ND
				total beta	7.1 E-15	4.6 E-10
296-A-26 (East Tank Farms/FDH) [E297]	9.4	HEPA	2.5 E+07	total alpha	ND	ND
				total beta	2,3 E-15	5.8 E-08
296-A-27 (East Tank Farms/FDH) [E270,E933,E934]	3.7	HEPA	1.5 E+07	^{90}Sr	1.1 E-15	1.6 E-08
				^{106}Ru	4.0 E-16	1.0 E-08
				^{113}Sn	ND	ND
				^{125}Sb	2.6 E-15	6.6 E-08
				^{129}I	3.1 E-13	4.7 E-06
				^{134}Cs	ND	ND
				^{137}Cs	4.0 E-16	6.2 E-09
				^{238}Pu	ND	ND
				$^{239/240}$Pu	4.2 E-17	6.4 E-10
				^{241}Am	8.5 E-17	1.3 E-09
				total alpha	3.8 E-16	5.9 E-09
				total beta	1.9 E-14	2.9 E-07
296-A-28 (East Tank Farms/FDH) [E272]	3.7	HEPA	4.3 E+07	total alpha	2.1 E-16	9.1 E-09
				total beta	4.9 E-15	2.2 E-07

Table 2-3 (8 sheets)

1996 Hanford Site Radionuclide Air Emissions Data for Minor Point Sources from FDH and BHI.
(minor point sources have the potential of <0.1 mrem/y EDE to nearest offsite resident)

Source ID[a] (Facility/Contractor) [EDP Codes]	Discharge Height (m)	Emission Control[b]	Total Flow (m^3)	Radionuclide	Average Concentration (μCi/mL)[c]	Annual Emissions (Ci)[c]
296-A-29 (East Tank Farms/FDH) [E901]	3.7	HEPA	1.1 E+07	total alpha total beta	6.8 E-16 6.4 E-14	7.6 E-09 7.0 E-07
296-A-30 (East Tank Farms/FDH) [E903]	3.7	HEPA	6.2 E+07	total alpha total beta	2.9 E-16 4.5 E-15	1.8 E-08 2.8 E-07
296-A-40 (East Tank Farms/FDH) [E013,E028,E029]	4.1	HEPA	1.4 E+07	^{90}Sr ^{106}Ru ^{113}Sn ^{125}Sb ^{129}I ^{134}Cs ^{137}Cs ^{238}Pu ^{239,240}Pu ^{241}Am total alpha total beta	1.9 E-16 3.8 E-16 ND ND 2.3 E-12 ND ND ND 1.5 E-17 1.9 E-17 1.5 E-16 2.5 E-15	2.6 E-09 5.8 E-09 ND ND 3.2 E-05 ND ND ND 2.1 E-10 2.6 E-10 2.0 E-09 3.5 E-08
296-A-41 (East Tank Farms/FDH) [E015]	8.9	HEPA	1.2 E+08	total alpha total beta	8.6 E-17 1.4 E-15	1.1 E-08 1.8 E-07
296-P-17 (East Tank Farms/FDH) [E120]	4.6	HEPA	0.0 E+00	total alpha total beta	(did not operate)	
296-P-31 (East Tank Farms/FDH) [E209]	10.0	HEPA	1.7 E+07	total alpha total beta	1.2 E-15 3.5 E-15	2.0 E-08 6.0 E-08
296-P-32 296-P-33 296-P-34 (Char. Project/FDH) [FDH]	4.6	HEPA	0.0 E+00	total alpha total beta	(did not operate)	
296-A-21 (242-A Evaporator/FDH) [E645]	6.7	HEPA	2.5 E+08	total alpha total beta	9.6 E-17 1.6 E-15	2.4 E-08 4.0 E-07
296-E-1 (ETF/FDH) [E036]	15.5	HEPA	8.2 E+08	total alpha total beta	9.3 E-17 9.6 E-16	7.7 E-08 8.0 E-07

Table 2-3 (8 sheets)

1996 Hanford Site Radionuclide Air Emissions Data for Minor Point Sources from FDH and BHI
(minor point sources have the potential of <0.1 mrem/y EDE to nearest offsite resident)

Source ID[a] (Facility/Contractor) [EDP Codes]	Discharge Height (m)	Emission Control[b]	Total Flow (m^3)	Radionuclide	Average Concentration (μCi/mL)[c]	Annual Emissions (Ci)[c]
296-G-1 (Grout/FDH) [E032]	7.6	HEPA	0.0 E+00	total alpha total beta	(did not operate)	
200 West Area Point Sources						
296-P-22 (West Tank Farms/FDH) [W191]	4.6	HEPA	1.3 E+07	total alpha total beta	1.1 E-16 1.5 E-15	1.5 E-09 2.0 E-08
296-P-23 296-P-28 (backup) (West Tank Farms/FDH) [W190,W195]	4.6	HEPA	1.3 E+07	total alpha total beta	6.8 E-17 8.1 E-14	9.0 E-10 1.1 E-06
296-S-15 (West Tank Farms/FDH) [W111]	4.6	HEPA	4.8 E+07	^{90}Sr ^{134}Cs ^{137}Cs ^{238}Pu ^{239,240}Pu ^{241}Am total alpha total beta	8.2 E-16 ND 2.5 E-15 ND 6.5 E-18 7.9 E-17 6.3 E-16 9.2 E-15	3.9 E-08 ND 1.2 E-07 ND 3.1 E-10 3.7 E-09 3.0 E-08 4.4 E-07
296-S-18 (West Tank Farms/FDH) [W096]	6.7	HEPA	1.1 E+08	total alpha total beta	7.0 E-16 1.2 E-15	7.5 E-08 1.3 E-07
296-T-17 (West Tank Farms/FDH) [W117]	10.1	HEPA	1.7 E+07	total alpha total beta	6.3 E-17 7.7 E-16	1.1 E-09 1.3 E-08
296-W-3 (West Tank Farms/FDH) [W003]	7.6	HEPA	2.5 E+07	total alpha total beta	1.8 E-16 3.0 E-15	4.4 E-09 7.7 E-08
291-S-1 (S Plant/BHI) [S006]	61.0	sand filter	3.1 E+08	total alpha total beta	7.8 E-16 9.0 E-15	2.4 E-07 2.8 E-06
296-S-2 (S Plant/BHI) [S032]	20.7	HEPA	1.0 E+07	total alpha total beta	2.1 E-15 1.2 E-14	2.1 E-08 1.2 E-07
296-S-4 (S Plant/BHI) [S008]	20.7	HEPA	0.0 E+00	total alpha total beta	(did not operate)	

Table 2-3 (8 sheets)

1996 Hanford Site Radionuclide Air Emissions Data for Minor Point Sources from FDH and BHI.
(minor point sources have the potential of <0.1 mrem/y EDE to nearest offsite resident)

Source ID[a] (Facility/Contractor) [EDP Codes]	Discharge Height (m)	Emission Control[b]	Total Flow (m^3)	Radionuclide	Average Concentration (μCi/mL)[c]	Annual Emissions (Ci)[c]
296-S-6 (S Plant/BHI) [S004]	39.4	none	0.0 E+00	total alpha total beta	(did not operate)	
296-S-7W 296-S-7E (backup) (S Plant/BHI) [S015,S016]	7.6	HEPA	1.3 E+08	total alpha total beta	4.9 E-15 1.2 E-15	6.5 E-07 1.6 E-07
291-U-1 (U Plant/BHI) [U771]	61.0	sand filter	4.0 E+08	total alpha total beta	1.8 E-15 1.6 E-13	7.3 E-07 6.8 E-05
291-T-1 (T Plant/FDH) [T785]	61.0	HEPA	4.9 E+08	total alpha total beta	1.4 E-13 5.5 E-13	7.0 E-05 2.7 E-04
296-T-7 (T Plant/FDH) [T154]	8.5	HEPA	2.8 E+07	total alpha total beta	4.0 E-16 9.3 E-16	1.1 E-08 2.6 E-08
296-T-13 (T Plant/FDH) [T786]	20.7	HEPA	3.2 E+07	total alpha total beta	ND 2.5 E-15	ND 7.9 E-08
296-T-11 (TRUSAF/FDH) [T783]	7.6	HEPA	0.0 E+00	total alpha total beta	(did not operate)	
296-T-12 (TRUSAF/FDH) [T784]	7.6	HEPA	1.4 E+08	total alpha total beta	1.4 E-15 6.2 E-15	2.0 E-07 8.8 E-07
296-S-16 (222-S/FDH) [S264]	3.0	HEPA	2.1 E+06	total alpha total beta	4.0 E-15 4.2 E-14	8.4 E-09 9.1 E-08
296-S-21 (222-S/FDH) [S289]	11.6	HEPA	1.1 E+09	total alpha total beta	ND 2.1 E-16	ND 2.4 E-07
296-Z-3 (PFP/FDH) [Z813]	7.6	HEPA	1.4 E+07	total alpha total beta	6.0 E-15 4.8 E-15	8.5 E-08 6.7 E-08
296-Z-5 (PFP/FDH) [Z913]	8.5	HEPA	1.8 E+08	total alpha total beta	2.2 E-16 1.3 E-15	4.0 E-08 2.4 E-07

Table 2-3 (8 sheets)

1996 Hanford Site Radionuclide Air Emissions Data for Minor Point Sources from FDH and BHI.
(minor point sources have the potential of <0.1 mrem/y EDE to nearest offsite resident)

Source ID[a] (Facility/Contractor) [EDP Codes]	Discharge Height (m)	Emission Control[b]	Total Flow (m^3)	Radionuclide	Average Concentration (μCi/mL)[c]	Annual Emissions (Ci)[c]
296-Z-6 (PFP/FDH) [Z802]	4.5	HEPA	1.4 E+08	total alpha total beta	2.5 E-16 1.6 E-15	3.4 E-08 2.3 E-07
296-Z-14 (PFP/FDH) [Z814]	6.1	HEPA	2.5 E+07	total alpha total beta	1.2 E-15 3.3 E-15	2.8 E-08 8.0 E-08
296-Z-15 (PFP/FDH) [Z915]	12.8	HEPA	2.4 E+07	total alpha total beta	ND ND	ND ND
696-W-1 (WSCF/FDH) [W010]	7.6	HEPA	7.3 E+08	total alpha total beta	ND 2.6 E-16	ND 1.9 E-07
696-W-2 (WSCF/FDH) [W011]	9.8	HEPA	1.4 E+07	total alpha total beta	9.3 E-17 7.0 E-16	1.3 E-09 9.6 E-09
300 Area Point Sources						
306-E-ULAB (306-E Bldg./FDH) [F003]	20.1	HEPA	0.0 E+00	total alpha total beta	(did not operate)	
308-TRIGA (308 Bldg./FDH) [F006]	11.3		6.9 E+06	^{131}I total alpha total beta	ND ND ND	ND ND ND
309-PRTR[d] (309 Bldg./FDH)	30.5	HEPA	4.9 E+06	total alpha total beta	2.5 E-16 5.9 E-15	1.2 E-09 2.9 E-08
309-RTF-EX[d] (309 Bldg./FDH)	4.0	HEPA	4.1 E+06	^{137}Cs	ND	<6.3 E-12
340-B-BLDG (340 Bldg./FDH) [F008]	11.6	HEPA	4.8 E+06	total alpha total beta	ND 1.2 E-14	ND 5.5 E-08
340-DECON (340 Bldg./FDH) [F009]	3.0	HEPA	1.1 E+08	total alpha total beta	6.3 E-16 6.4 E-15	6.7 E-08 6.8 E-07
377-GEL (377 Bldg./FDH) [F010]	10.0	HEPA	9.9 E+06	total alpha total beta	ND ND	ND ND

Table 2-3 (8 sheets)

1996 Hanford Site Radionuclide Air Emissions Data for Minor Point Sources from FDH and BHI.
(minor point sources have the potential of <0.1 mrem/y EDE to nearest offsite resident)

Source ID[a] (Facility/Contractor) [EDP Codes]	Discharge Height (m)	Emission Control[b]	Total Flow (m^3)	Radionuclide	Average Concentration (μCi/mL)[c]	Annual Emissions (Ci)[c]
400 Area Point Sources						
FFTF-CB-EX (FFTF/FDH) [F011]	14.3	none	3.1 E+08	^{3}H (as HTO) ^{131}I total alpha total beta	1.1 E-08 ND 9.3 E-16 6.4 E-15	3.6 E+00 ND 2.9 E-07 2.0 E-06
FFTF-RE-SB (FFTF/FDH) [F012]	6.1	none	2.0 E+08	^{131}I total alpha total beta	ND 1.5 E-15 1.2 E-14	ND 2.8 E-07 2.3 E-06
FFTF-HT-TR (FFTF/FDH) [F013]	8.8	none	7.9 E+07	total alpha total beta	8.2 E-16 4.4 E-15	6.5 E-08 3.5 E-07
437-MN&ST (MASF/FDH) [F014]	9.1	HEPA	2.0 E+08	total alpha total beta	6.0 E-16 2.9 E-15	1.2 E-07 5.7 E-07
437-1-61 (MASF/FDH) [F019]	11.7	HEPA	2.4 E+08	total alpha total beta	3.0 E-16 7.9 E-16	7.3 E-08 1.9 E-07

Notes:

a ID = Identification, i.e., the alpha-numeric designator for the respective point source; FDH = Fluor Daniel Hanford, Inc.; BHI = Bechtel Hanford, Inc.

b Efficiencies are: ≥99.95% for HEPA; ≥95% for charcoal; ≥99.8% for sand filter; 0% for no emission control.

c 1 μCi/mL = 3.7 E+10 Bq/mL; 1 Curie = 3.7 E+10 becquerel; ND = none detected (i.e. either the radionuclide was not detected in any sample during the year, or the average of all the measurements for that given radionuclide or type of radioactivity made during the year was below background levels).

Table 2-4 (2 sheets)

1996 Hanford Site Nonradioactive Air Emissions Data by Source

Source Identification (Contractor[a])	Constituent	Annual Emissions (kg)[b]
200 East Area Powerhouse (FDH)	**Criteria Air Pollutants:**	
	Particulate Matter	1.78 E+03
	Nitrogen Oxides (NO_x)	1.85 E+05
	Sulfur Oxides (SO_x)	2.46 E+05
	Carbon Monoxide (CO)	6.76 E+04
	Lead	1.73 E+02
	Volatile Organic Compounds	6.76 E+02
	Toxic Air Pollutants:	
	Arsenic	1.85 E+02
	Beryllium	2.50 E+01
	Cadmium	1.47 E+01
	Chromium	5.37 E+02
	Cobalt	0.00
	Copper	3.37 E+02
	Formaldehyde	7.55 E+01
	Manganese	7.42 E+02
	Mercury	5.47 E+00
	Nickel	4.41 E+02
	Polycyclic Organic Matter	0.00
	Selenium	6.70 E+01
	Vanadium	4.62 E+01
200 West Area 284-WB Oil Fired Package Boiler (FDH)	**Criteria Air Pollutants:**	
	Particulate Matter	2.91 E+01
	Nitrogen Oxides (NO_x)	2.92 E+02
	Sulfur Oxides (SO_x)	1.03 E+02
	Carbon Monoxide (CO)	7.27 E+01
	Lead	1.81 E-02
	Volatile Organic Compounds	2.91 E+00
	Toxic Air Pollutants:	
	Arsenic	8.55 E-03
	Beryllium	5.09 E-03
	Cadmium	2.24 E-02
	Chromium	9.67 E-02
	Cobalt	0.00
	Copper	5.70 E-01
	Formaldehyde	8.24 E-01
	Manganese	2.85 E-02
	Mercury	6.11 E-03
	Nickel	3.66 E-02
	Polycyclic Organic Matter	3.20 E+02
	Selenium	4.78 E-02
	Vanadium	1.42 E-01

Table 2-4 (2 sheets)

1996 Hanford Site Nonradioactive Air Emissions Data by Source		
Source Identification (Contractor[a])	**Constituent**	**Annual Emissions (kg)[b]**
300 Area Powerhouse (FDH)	**Criteria Air Pollutants:**	
	Particulate Matter	1.23 E+04
	Nitrogen Oxides (NO_x)	4.16 E+04
	Sulfur Oxides (SO_x)	1.68 E+05
	Carbon Monoxide (CO)	3.78 E+03
	Lead	2.24 E+01
	Volatile Organic Compounds	2.12 E+02
	Toxic Air Pollutants:	
	Arsenic	1.32 E+01
	Beryllium	4.85 E-01
	Cadmium	2.44 E+01
	Chromium	1.48 E+01
	Cobalt	1.40 E+01
	Copper	3.21 E+01
	Formaldehyde	4.68 E+01
	Manganese	8.55 E+00
	Mercury	3.70 E+00
	Nickel	2.69 E+02
	Polycyclic Organic Matter	6.35 E+03
	Selenium	4.39 E+00
	Vanadium	3.49 E+02
East Tank Farms & 242-A Evaporator Operations (FDH)	Volatile Organic Compounds	6.72 E+02
	Ammonia	7.07 E+03
West Tank Farms Operations (FDH)	Volatile Organic Compounds	1.70 E+02
	Ammonia	3.32 E+03
200 West Area CCl_4 Vapor Extraction Project (BHI)	Carbon Tetrachloride	9.07 E-01

Notes:
a FDH = Fluor Daniel Hanford, Inc.; BHI = Bechtel Hanford, Inc.
b Powerhouse emissions calculated EPA emission factors and based on total fuel consumption.

Table 2-5

1996 Fuel Consumption from Hanford's Powerhouse Boilers

Fuel Consumed	Source: 200 East Area Powerhouse	200 West Area Powerhouse	300 Area Powerhouse
Coal, kg	2.70 E+07		
Grade 2 Oil, L		1.21 E+05	
Grade 6 Oil, L			6.30 E+06

3.0 LIQUID EFFLUENTS

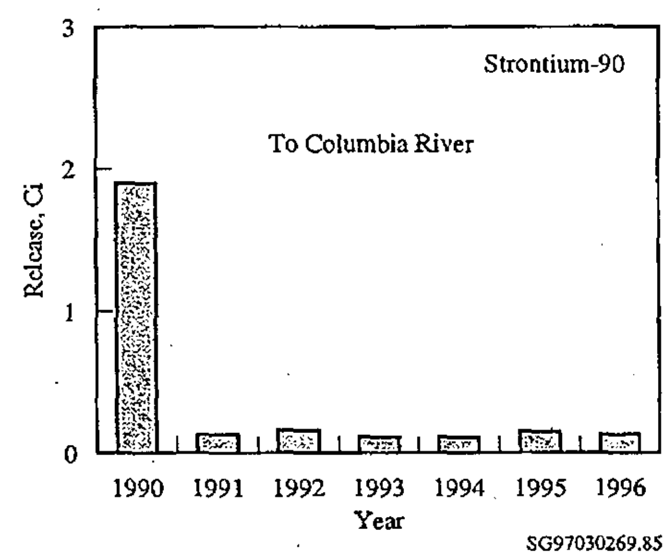
The majority of liquid effluents released to the environment from facilities and activities managed by FDH and BHI were discharged under the appropriate state and federal discharge permits. Data on the 1996 radioactive and nonradioactive liquid effluents are presented in this section.

3.1 RADIOACTIVE LIQUID EFFLUENTS

Facilities and activities managed by FDH and BHI discharge liquid effluents potentially or normally contaminated with radionuclides to the soil or the Columbia River. The general categories of these liquid effluents are: (1) cooling water, (2) steam condensates, (3) process condensates, (4) laboratory and chemical sewer waste water, (5) filter backwash, and (7) groundwater seepage resulting from discharges to the soil.

The measured quantities of radionuclides discharged in liquid effluents to ground disposal facilities and to the Columbia River are summarized in Tables ES-2 and ES-3, respectively. Releases of specific radionuclides and total activity discharged by individual liquid effluent streams is presented in Table 3-1. Included in these tables are releases to the Columbia River adjacent to 100-N Area via groundwater seepage along the stretch of riverbank known as the N-Springs, see Figure 3-1.

Figure 3-1
Historical Liquid Effluent Releases of ^{90}Sr to the Columbia River.



In the 100-N Area, total radionuclide releases continued to be far below releases which occurred during N-Reactor operation.

In the 200 Areas, the 200 Area Treated Effluent Disposal Facility (TEDF) started processing liquid effluents from radioactive liquid effluent streams in May of 1995. The 200 Area TEDF's effluents comply with the Clean Water Act and meet the drinking water standard.

The 242-A Evaporator operated in 1996 to process liquid radioactive material, some effluents were discharged to the 216-B-3 Pond as a result of its operation.

Discharges to French drains and from the two sources at T Plant are not sampled or measured for flow. This is because the effluents are judged not to have a potential of exceeding 4% of the DCG values on a yearly average. Four percent of a DCG is equivalent to 4 mrem, which is the drinking water standard (Radiological Drinking Water Standards: U.S. Environmental Protection Agency, *National Primary Drinking Water Regulations* (40 CFR Part 141); and State of Washington's Administrative Code, *Public Water Supplies* (WAC Chapter 246-290)).

In the 300 Area, there were no radioactive liquid effluent releases to the environment in 1996. All radioactive liquid effluents were transported to the 200 Area Tank Farms via the 340 Facility in the 300 Area.

3.2 NONRADIOACTIVE LIQUID EFFLUENTS

3.2.1 Sanitary Sewage Discharges to the Soil

Various facilities discharged sanitary sewage. In the 100-N Area, sanitary waste water was discharged to the 100-N Sewage Lagoon and five septic tanks. In the 100-B, 100-D, 100-H, and 100-K Areas, sanitary sewage was discharged to septic-tanks and drain-fields. In the 200 Areas, sanitary waste water was discharged to a system of septic tanks and drain-fields. Sludge was pumped from septic tanks in the 200 Areas and taken to the 100-N Sewage Lagoon for disposal. In the 300 Area, sanitary sewage was discharged to the 300 Area septic tank and trench system, until October 1, 1996, when discharges started going to the City of Richland's POTW. In the 400 Area, sanitary sewage was discharged to a sewage treatment plant and lagoon, until April 15, 1997, when discharges started going to the Washington Public Power Supply's sewage treatment plant.

The estimated volume of sewage discharged by area during 1996 is shown in Table 3-2. All sanitary sewer discharges are estimated by multiplying the total number of employees and subcontractors stationed in each area by 95 L/day-person (25 gal/day-person).

3.2.2 National Pollutant Discharge Elimination System Discharges

Liquid effluents discharged to the Columbia River from the 100-N Area, 100-K Area, and 300 Area are regulated by the parameters in the NPDES permits for the Hanford Site. A list of the discharge points is provided in Table 3-3. A summary of analyses performed to ensure compliance with the NPDES permits is given Table 3-4.

All non-radioactive liquid effluents from the 300 Area are being discharged to the 300 Area's Treated Effluent Disposal Facility (TEDF), as of October 1, 1996. The 300 Area's TEDF discharged 3.8 E+08 L (1.0 E+08 Gal) of nonhazardous nonradioactive liquid wastes to the Columbia River in 1996.

3.2.3 Permitted Discharges to the Soil

Two liquid effluent streams have discharge permits with Ecology allowing discharges of radioactive and hazardous materials, within permitted limits, to the soil column. The 200 East Area's TEDF discharges liquid effluents, which meet the drinking water standard. The 200 East Area's Effluent Treatment Facility treats liquid effluents containing radioactive and hazardous constituents, minimizing the discharges of these substances to the environment. Radioactive and hazardous constituents are monitored for from each of these streams and reported quarterly to Ecology.

The volume of nonhazardous nonradioactive liquid wastes discharged by the 200 Area TEDF to the soil in 1996 was 6.9 E+08 L (1.8 E+08 Gal). The volume of liquid wastes discharged by the 200 Area ETF to the soil in 1996 was 3.1 E+07 L (8.2 E+06 Gal). Table 3-1 contains a summary of the radionuclides discharged to the soil by 200 Area ETF. Table 3-5 contains a summary of the discharge monitoring report (DMR) data reported to Ecology.

3.2.4 Process Water Discharges

Facilities managed by FDH discharged nonhazardous waste water to the ground at the Hanford Site.

The 200 East Area's 284-E Powerhouse, 282-E Raw Water Reservoir, and the 283-E Water Treatment Plant discharged waste water totalling approximately 2.99 E+08 L (7.91 E+07 gal) to the soil column via an open trench with overflow to the 216-B-3 Pond. 200 East Area process water discharges are estimated by multiplying the total minutes of operation, in a year, by an estimated average flow rate of 568 L/min (150 gal/min). The 200 West Area's 284-WB Oil Fired boiler, 282-W Raw Water Reservoir, and the 283-W Water Treatment Plant no longer discharge to the environment. Discharges from these 200 West Area facilities were sent to the 200 Area TEDF.

In the 400 Area, approximately 4.5 E+07 L (1.2 E+07 gal) of process nonhazardous nonradioactive waste water from the 400 Area Process Sewer drained to a process pond located north of the 400 Area. Approximately ≤1.7 E+06 L (≤4.4 E+05 gal) of liquid wastes (principally storm water) drained to 24 French drains.

Industrial facilities managed by FDH and BHI did not discharge to the City of Richland's POTW any waste water that could be classified as a significant industrial discharge. Significant industrial discharges are defined as those meeting any of the following criteria:

- Being subject to national pretreatment standards promulgated under Section 307 (b) or (c) of the *Clean Water Act of 1977*
- Having any of the priority toxic pollutants listed in 40 CFR 403
- Having toxic pollutants as defined in the *Clean Water Act of 1977*, Section 307
- Having a discharge flow of 1.5 E+05 L (4.0 E+04 gal) or more per average workday
- Having a flow greater than 5% of the flow of the POTW.

Such discharges are prohibited unless issued a permit by the City of Richland.

Table 3-1 (4 sheets)

1996 Radionuclide Liquid Effluent Data for Individual Effluent Streams Discharged to the Environment from FDH and BHI Facilities.					
Liquid Effluent Stream[a] [Contractor] (Stream Code, EDP Code)	**Discharge Disposal Site**	**Total Flow (L)**	**Radionuclide**	**Average Concentration (μCi/mL)[b]**	**Annual Release (Ci)[b]**
100 Area Discharges to the Columbia River					
N-Springs [BHI] (N/A, Y101)	Columbia River	2.2 E+07	^{3}H ^{90}Sr	5.8 E-06 5.5 E-06	1.3 E-01 1.2 E-01
NPDES Outfall 004, 100-K 1908-K Outfall [FDH] (N/A, Y130)	Columbia River	1.6 E+09	^{3}H ^{60}Co ^{90}Sr ^{106}Ru ^{125}Sb ^{134}Cs ^{137}Cs ^{154}Eu ^{155}Eu ^{238}Pu $^{239/240}Pu$ ^{241}Am total alpha total beta	ND 1.5 E-09 1.0 E-09 ND 2.2 E-09 ND 2.4 E-09 ND 7.7 E-10 2.6 E-11 ND 7.3 E-11 8.6 E-11 2.3 E-09	ND 2.3 E-03 1.6 E-03 ND 3.5 E-03 ND 3.8 E-03 ND 1.2 E-03 4.0 E-05 ND 1.1 E-04 1.3 E-04 3.6 E-03
200 Area Discharges to the Ground					
222-S Laboratory Chemical Sewer [FDH] (207-SL, H101)	216-S-26 Crib	0.0	N/A	N/A	N/A
UO_3 Plant Waste Water [FDH] (207-U, H102)	216-U-14 Ditch	0.0	N/A	N/A	N/A
PFP Cooling Water [FDH] (2904-ZA, H103)	216-Z-20 Crib	0.0	N/A	N/A	N/A

Table 3-1 (4 sheets)

1996 Radionuclide Liquid Effluent Data for Individual Effluent Streams Discharged to the Environment from FDH and BHI Facilities.

Liquid Effluent Stream[a] [Contractor] (Stream Code, EDP Code)	Discharge Disposal Site	Total Flow (L)	Radionuclide	Average Concentration (μCi/mL)[b]	Annual Release (Ci)[b]
242-A Evaporator Cooling Water [FDH] (ACW, H108)	216-B-3 Pond	2.2 E+09	^{3}H	ND	ND
			^{90}Sr	ND	ND
			^{106}Ru	ND	ND
			^{113}Sn	ND	ND
			^{125}Sb	ND	ND
			^{134}Cs	ND	ND
			^{137}Cs	ND	ND
			^{234}U	3.6 E-10	8.1 E-04
			^{235}U	ND	ND
			^{238}U	2.5 E-10	5.7 E-04
			^{238}Pu	ND	ND
			$^{239/240}Pu$	ND	ND
			^{241}Am	9.1 E-11	2.0 E-04
			total alpha	ND	ND
			total beta	9.6 E-10	2.1 E-03
242-A Evaporator Steam Condensate [FDH] (ASC, H110)	216-B-3 Pond	8.4 E+06	^{3}H	1.9 E-08	1.6 E-04
			^{90}Sr	4.9 E-10	4.2 E-06
			^{106}Ru	ND	ND
			^{113}Sn	ND	ND
			^{125}Sb	ND	ND
			^{134}Cs	ND	ND
			^{137}Cs	8.0 E-10	6.7 E-06
			^{238}Pu	2.0 E-11	1.7 E-07
			$^{239/240}Pu$	ND	ND
			^{241}Am	ND	ND
			total alpha	7.3 E-11	6.1 E-07
			total beta	1.9 E-09	1.6 E-05
241-A Tank Farm Cooling Water [FDH] (CA8, H115)	216-B-3 Pond	8.6 E+08	^{90}Sr	1.3 E-10	1.1 E-04
			^{106}Ru	ND	ND
			^{113}Sn	ND	ND
			^{125}Sb	ND	ND
			^{134}Cs	ND	ND
			^{137}Cs	ND	ND
			^{238}Pu	2.3 E-11	2.0 E-05
			$^{239/240}Pu$	2.6 E-11	2.2 E-05
			^{241}Am	7.3 E-11	6.3 E-05
			total alpha	3.1 E-10	2.7 E-04
			total beta	7.7 E-10	6.6 E-04

Table 3-1 (4 sheets)

1996 Radionuclide Liquid Effluent Data for Individual Effluent Streams Discharged to the Environment from FDH and BHI Facilities.

Liquid Effluent Stream[a] [Contractor] (Stream Code, EDP Code)	Discharge Disposal Site	Total Flow (L)	Radionuclide	Average Concentration (μCi/mL)[b]	Annual Release (Ci)[b]
244-AR Vault Cooling Water [FDH] (CAR, H116)	216-B-3 Pond	2.0 E+06	^{90}Sr	8.0 E-11	1.6 E-07
			^{106}Ru	ND	ND
			^{113}Sn	ND	ND
			^{125}Sb	ND	ND
			^{134}Cs	ND	ND
			^{137}Cs	ND	ND
			^{238}Pu	8.2 E-11	1.7 E-07
			$^{239/240}Pu$	2.1 E-11	4.1 E-07
			^{241}Am	5.0 E-11	1.0 E-07
			total alpha	1.7 E-10	3.4 E-07
			total beta	7.3 E-10	1.5 E-06
B-Plant Cooling Water [FDH] (CBC, H117)	216-B-3 Pond	2.1 E+09	^{90}Sr	ND	ND
			^{106}Ru	ND	ND
			^{113}Sn	ND	ND
			^{125}Sb	ND	ND
			^{134}Cs	ND	ND
			^{137}Cs	ND	ND
			total alpha	5.8 E-10	1.2 E-03
			total beta	6.7 E-10	1.4 E-03
PUREX Chemical Sewer[c] [FDH] (CSL, H118)	216-B-3 Pond	0.0	N/A	N/A	N/A
242-S Evaporator Steam Condensate [FDH] (RC-1, H122)	216-U-14 Ditch	0.0	N/A	N/A	N/A
UO_3 Plant Process Condensate [FDH] (U-17, H126)	216-U-17 Crib	0.0	N/A	N/A	N/A
200 Area Effluent Treatment Facility[d] [FDH] (ETF, H129)	616-A Crib (SALDS)	3.1 E+07[d]	^{3}H	7.0 E-03	2.2 E+02
			^{14}C	2.7 E-09	8.5 E-05
			^{90}Sr	8.3 E-10	2.6 E-05
			^{99}Tc	4.8 E-09	1.5 E-04
			^{137}Cs	ND	ND
			^{238}Pu	1.4 E-10	4.4 E-06
			$^{239/240}Pu$	1.4 E-10	4.3 E-06
			^{241}Am	1.0 E-10	3.2 E-06
			total alpha	4.7 E-10	1.5 E-05
			total beta	6.3 E-10	1.9 E-05

Table 3-1 (4 sheets)

1996 Radionuclide Liquid Effluent Data for Individual Effluent Streams Discharged to the Environment from FDH and BHI Facilities.					
Liquid Effluent Stream[a] [Contractor] (Stream Code, EDP Code)	Discharge Disposal Site	Total Flow (L)	Radionuclide	Average Concentration (μCi/mL)[b]	Annual Release (Ci)[b]
300 Area Discharges to the Ground					
300 Area Process Sewer [FDH]	316-5 Trench	0.0	N/A	N/A	N/A

Notes:

a FDH = Fluor Daniel Hanford, Inc.; BHI = Bechtel Hanford, Inc; EDP Code = Electronic Data Processing Code.

b 1 μCi/mL = 3.7 E+10 Bq/m^3; 1 Curie = 3.7 E+10 Becquerel; ND = None Detected.

c PUREX Chemical Sewer releases include all discharges to PUREX A-42 Diversion Basin.

d The 1996 discharges for ETF include discharges from the last two weeks of 1995, which were not included in last year's report.

Table 3-2

Sanitary Sewage Discharged in 1996

Area	Discharge[a] (L/yr)	Discharge[a] (gal/yr)
100-D	4.8 E+05	1.3 E+05
100-H	0.0	0.0
100-K	1.1 E+07	2.9 E+06
100-N	1.6 E+07	4.1 E+06
200 East	7.9 E+07	2.1 E+07
200 West	5.9 E+07	1.6 E+07
300	4.4 E+07	1.2 E+07
400	1.5 E+07	4.0 E+06

a Discharges estimated by multiplying the total number of persons assigned to each area by 95 L/day-person (25 gal/day-person).

Table 3-3

National Pollutant Discharge Elimination System (NPDES) and State Permitted Discharge Points

Designation	Description
NPDES Discharge Points	
001A	300 Area Treated Effluent Disposal Facility (TEDF)
003*	181-KE Inlet Screen Backwash
004	1908-K Outfall
005*	182-N Tank Farm Overflow (36-in. raw water return)
006*	182-N Drain System (42-in. raw water return)
007*	181-N Inlet Screen Backwash
009*	102-in. Outfall (raw water return)
N-Springs	100-N Riverbank Springs
State Permitted Discharge Points	
ST 4500	200 Area Effluent Treatment Facility (ETF)
ST 4501	400 Area Secondary Cooling Water
ST 4502	200 Area Treated Effluent Disposal Facility (TEDF)

* Did not discharge any effluent during 1996.

Table 3-4 (2 sheets)

Summary of National Pollutant Discharge System (NPDES) Data System for 1996[a]						
Sample Parameter	1908-K Outfall (004)		N-Springs (1301-N)		300 Area TEDF (001A)	
	Avg	Max	Avg	Max	Avg	Max
Flow Rate (MGD)	1.08	4.90	*	*	0.274	0.399
Temperature (°F)	*	72.0	*	63.5	77.2	93.3
pH (minimum and maximum)	4.2	8.9	7.8	8.2	6.07	8.77
Total Suspended Solids (μg/L)	0.7	6.0	*	*	1200	11000
Oil and Grease (mg/L)	*	*	11.58	73.00	*	*
Aluminum (μg/L)	*	*	*	*	17.4	72.6
Arsenic (μg/L)	*	*	*	*	3.0	11.0
Beryllium (μg/L)	*	*	*	*	0.1	0.2
Cadmium (μg/L)	*	*	*	*	<0.8	<0.8
Chromium (mg/L)	*	*	0.0028	0.0044	*	*
Chlorine (mg/L)	0.01	0.16	*	*	*	*
Copper (μg/L)	*	*	*	*	2.7	8.6
Iron (μg/L)	*	*	104	190	58.6	821.0
Lead (μg/L)	*	*	*	*	0.3	0.6
Manganese (μg/L)	*	*	*	*	0.7	5.1
Mercury (μg/L)	*	*	*	*	<0.1	<0.1
Nickel (μg/L)	*	*	*	*	2.8	11.0
Radium (pCi/L)	*	*	*	*	<0.13	<0.13
Selenium (μg/L)	*	*	*	*	<3	<3
Silver (μg/L)	*	*	*	*	0.1	0.2
Zinc (μg/L)	*	*	*	*	4.3	11.4
Nitrogen (as ammonia) (μg/L)	*	*	50	50	59.2	100.0
Bis (2-ethylhexyl) phthalate (μg/L)	*	*	*	*	1.5	3.0
Chlorodiflouromethane (μg/L)	*	*	*	*	<0.1	<0.1
Chloroform (μg/L)	*	*	*	*	4.4	10.0
Coliform (growth/100mL)	*	*	*	*	<5	<5
Cyanide (μg/L)	*	*	*	*	<3.7	<3.7

Table 3-4 (2 sheets)

Summary of National Pollutant Discharge System (NPDES) Data System for 1996[a]

Sample Parameter	1908-K Outfall (004)		N-Springs (1301-N)		300 Area TEDF (001A)	
	Avg	Max	Avg	Max	Avg	Max
Dichlorobromomethane (μg/L)	*	*	*	*	<5.0	<5.0
1,1-Dichloroethane (μg/L)	*	*	*	*	<4.7	<4.7
Methylene Chloride (μg/L)	*	*	*	*	<3	<3
Nitrite (NO_2) (μg/L)	*	*	*	*	<60	<60
Tetrachloroethylene (μg/L)	*	*	*	*	<5	<5
1,1,1-Trichloroethane (μg/L)	*	*	*	*	<5.0	<5.0
Trichloroethylene (μg/L)	*	*	*	*	<1.9	<1.9
Toluene (μg/L)	*	*	*	*	<6.0	<6.0

a MGD = million gallons per day; * = analysis not required.

Table 3-5 (2 sheets)

Summary of the 1996 Discharge Monitoring Reports for State Permitted Discharge Points[a]

Sample Parameter	200 Area Effluent Treatment Facility (ST 4500)		400 Area Secondary Cooling Water (ST 4501)		200 Area TEDF (ST 4502)	
	Avg	Max	Avg	Max	Avg	Max
Flow Rate (gpm)	265	320	16.4	27.2	347	395
pH (minimum and maximum)	*	*	8.3	8.7	6.4	9.7
Conductivity (µmhos/cm)	12.55	18.00	*	*	154.0	179.0
Total Suspended Solids (µg/L)	1838	3340	*	*	1200	11000
Total Dissolved Solids (µg/L)	NQ	NQ	529250	547500	76858	134000
Total Organic Carbon (µg/L)	NQ	NQ	*	*	*	*
Total Organic Halides (µg/L)	*	*	73.4	108.0	*	*
Total Trihalomethanes (µCi/L)	*	*	*	*	NQ	NQ
Oil and Grease (mg/L)	*	*	*	*	NQ	NQ
Arsenic (µg/L)	NQ	NQ	*	*	NQ	NQ
Beryllium (µg/L)	NQ	NQ	*	*	*	*
Cadmium (µg/L)	NQ	NQ	*	*	NQ	NQ
Chromium (mg/L)	NQ	NQ	*	*	NQ	NQ
Cobalt (µg/L)	*	*	*	*	*	*
Copper (µg/L)	NQ	NQ	*	*	*	*
Iron (µg/L)	*	*	*	*	127.0	673.0
Lead (µg/L)	NQ	NQ	*	*	NQ	NQ
Manganese (µg/L)	*	*	*	*	NQ	NQ
Mercury (µg/L)	*	*	*	*	NQ	NQ
Nitrogen (µg/L)	NQ	NQ	*	*	*	*
Acetophenone (µg/L)	NQ	NQ	*	*	*	*
Ammonia (µg/L)	35	42	*	*	*	*
Benzene (µg/L)	NQ	NQ	*	*	*	*
Bis (2-ethylhexyl) Phthalate (µg/L)	*	*	*	*	NQ	NQ
Carbon Tetrachloride (µg/L)	NQ	NQ	*	*	NQ	NQ
Chloride (µg/L)	*	*	26400	29600	6125	118000
Chloroform (µg/L)	NQ	NQ	*	*	7.1	13.0

Table 3-5 (2 sheets)

Summary of the 1996 Discharge Monitoring Reports for State Permitted Discharge Points[a]

Sample Parameter	200 Area Effluent Treatment Facility (ST 4500)		400 Area Secondary Cooling Water (ST 4501)		200 Area TEDF (ST 4502)	
	Avg	Max	Avg	Max	Avg	Max
Cyanide (μg/L)	*	*	*	*	NQ	NQ
Methylene Chloride (μg/L)	*	*	*	*	NQ	NQ
Nitrate (NO_3) (μg/L)	NQ	NQ	*	*	193	601
Nitrite (NO_2) (μg/L)	NQ	NQ	*	*	*	*
N-Nitrosodiumethylamine (μg/L)	NQ	NQ	*	*	*	*
Phenol (μg/L)	*	*	*	*	NQ	NQ
Phosphorus (μg/L)	*	*	798.0	858.0	*	*
Sulfate (μg/L)	NQ	NQ	*	*	12891	23414
Tetrachloroethylene (μg/L)	NQ	NQ	*	*	*	*
1,1,1-Trichloroethane (μg/L)	*	*	*	*	NQ	NQ
1,1,2-Trichloroethane (μg/L)	NQ	NQ	*	*	*	*
Tetrahydrofuran (μg/L)	NQ	NQ	*	*	*	*
WTPH-G (μg/L)	*	*	*	*	NQ	NQ
Gross Alpha (pCi/L)	NQ	NQ	*	*	NQ	NQ
Gross Beta (pCi/L)	NQ	NQ	23.8	24.4	NQ	NQ
Ra-226 (pCi/L)	*	*	*	*	NQ	NQ
Ra-226 & Ra-228 (pCi/L)	*	*	*	*	NQ	NQ
Sr-90 (pCi/L)	NQ	NQ	*	*	*	*
Tritium (pCi/L)	*	*	4730	5030	*	*
Tritium (Ci/month)	30.6	57.1	*	*	*	*

a * = analysis not required; NQ = Non-Quantifiable (i.e. below practical quantification limits (PQL)).

4.0 HAZARDOUS SUBSTANCE RELEASES

A hazardous substance release requires notification to appropriate federal, state, and local authorities when established limits are exceeded. Reportable releases of hazardous substances are classified as the following two types:

- Nonroutine releases
- Continuous, routine releases.

Information for each type of release is discussed separately below.

4.1 NONROUTINE RELEASES

The following listing shows the number of nonroutine releases of a solid, liquid, or airborne substances in 1996, which includes: radioactive material, hazardous or dangerous wastes, hazardous or extremely hazardous substances, polychlorinated biphenyls (PCBs), and oil or petroleum products. Other nonroutine releases and spills are not discussed in this section because they were less than agency reportable limits and the levels in DOE reporting criteria (EPA 1990b, DOE 1993b).

- 18 releases (15 FDH and FDH contractors, 3 BHI and BHI contractors) were reported to a regulatory agency
- 266 releases, which were not reportable to regulatory agencies, but recorded per DOE Order 232.1 criteria (265 FDH and FDH contractors, 1 BHI and BHI contractors), were recorded.

4.2 ROUTINE CONTINUOUS RELEASES

Releases of hazardous substances that exceed CERCLA reportable quantities (RQ) need not be reported immediately to the National Response Center when both of the following conditions are met:

- An initial notification has been completed
- The routine releases are continuous and stable in quantity and rate.

The initial notification requirement has been satisfied concerning hazardous substances that have exceeded or have a potential to exceed an RQ. Historically only the continuous routine releases of ammonia, ammonium hydroxide, and carbon tetrachloride have posed operational difficulties in staying beneath RQs. For 1996, releases of ammonia, ammonium hydroxide, and carbon tetrachloride were below reportable quantities and were continuous and stable in quantity and rate. Information on the routine releases of hazardous substances are presented in Table 4-1.

Table 4-1

Comprehensive Environmental Response, Compensation, and Liability Act of 1980 Continuous Release Summary for Calendar Year 1996.[a]					
Release Point	**Substance**	**CERCLA RQ[b] (kg [lb])**	**Number of Occurrences Exceeding RQ Value**	**Mean Release[c] (kg [lb])**	**Annual Quantity (kg [lb])**
200 East Area Tank Farms and 242-A Evaporator	ammonia	45.4 (100.0)	0	19.4 [42.6]	7.07 E+03 [1.56 E+04]
200 West Area Tank Farms	ammonia	45.4 (100.0)	0	9.1 [20.0]	3.32 E+03 [7.30 E+03]
200 West Area CCl_4 Vapor Extraction Project	carbon tetrachloride	4.54 (10.00)	0	3.3 E-03 [7.2 E-03]	9.07 E-01 [2.00 E+00]
291-Z-1 (Plutonium Reclamation Facility)	carbon tetrachloride	4.54 (10.00)	0	(did not operate)	

a All quantities are for any continuous 24-hr period.
b CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980; RQ = Reportable quantity
c Mean release is the annual quantity divided by the number of operating days in the calendar year (e.g. 365 days).

5.0 REFERENCES

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APPENDIX A

POINT SOURCES FOR RADIONUCLIDE AIR EMISSIONS

APPENDIX A

POINT SOURCES FOR RADIONUCLIDE AIR EMISSIONS

A.1 GENERAL DESCRIPTION AND REPORTING CRITERIA

Radionuclide air emissions from point sources generally are discharged from stacks and vents (further reference to stacks implies vents as well, unless used as the proper name or description of a point source). Stack sizes, shapes, and discharge paths vary because of facility requirements at the time of construction. Discharge heights range from a few feet to 200 ft (61 m), and flow rates range from less than 100 ft^3/min (2,832 L/min) to more than 200,000 ft^3/min (5.7 million L/min). Stacks vary in design from horizontal to vertical, rectangular to cylindrical, actively ventilated to passively ventilated, and permanent to portable.

The following are examples of methods used to remove radionuclides from air emissions: (1) high-efficiency particulate air (HEPA) filters; (2) sand filters; (3) deep-bed fiberglass filters; (4) fiberglass prefilters; (5) charcoal absorbers; and (6) water scrubbers. Generally, between one and three stages of HEPA filtration are used as the final particle removal method before an emission is exhausted to the atmosphere.

This section includes emissions estimates for 125 point sources on the Hanford Site. Point sources reported in this document met the following criteria during 1996: (1) point source required continuous monitoring or periodic confirmatory measurements by 40 CFR 61 Subpart H or WAC 246-247, (2) point source was registered with Washington State Department of Health (WDOH), (3) the point source normally had radionuclide emissions or potentially had radionuclide emissions. Point sources not included in this section did not meet the previous criteria or their air emissions were not forcibly discharged (e.g. passively ventilated, sealed off, deactivated, etc...). Air emissions forcibly discharged (actively ventilated) by exhaust fans are sampled only if radioactive material could be potentially released.

A.2. 100 AREAS FACILITIES

The 100 Areas contain eight inactive production reactors, the N Reactor (now in transition to deactivation and decommissioning), and associated support facilities. Radionuclide air emission points at facilities in the 100-N Area and 100-K Area are described briefly below and shown respectively in Figures 1-2 and 1-3. The remaining reactor areas have sources of diffuse and fugitive emissions, but have no point sources.

A.2.1 N Reactor

This dual-purpose reactor operated until 1987, producing electrical power for the regional energy system and plutonium for weapons production. The reactor and associated facilities are currently being deactivated prior to decommissioning.

- **116-N**. This stack exhausts filtered air from the 105-N Reactor Building. Emission monitoring consists of a record sampler. In 1993 N Reactor ventilation was reconfigured such that the 105-N Basin Transfer Area emissions exhaust through the 116-N stack.

- **107-N**. This vent exhausts filtered air from the 107-N Basin Recirculation Building. Emissions monitoring consists of a record sampler.

- **105-N 14-Ft. Decontamination Room**. This stack did not operate in 1996 and was deactivated in April 1997.

A.2.2 100-K East and West Areas

These areas contain two retired reactors awaiting decommissioning, two water-filled storage basins storing irradiated nuclear fuel, and radiological analysis laboratories.

- **105-KE**. This point source consists of four powered vents exhausting unfiltered air from the spent fuel storage basin in the 105-KE Building. Emission monitoring consists of four record samplers.

- **105-KW**. This point source consists of four powered vents exhausting unfiltered air from the spent fuel storage basin in the 105-KW Building. Emission monitoring consists of three record samplers.

- **1706-KE**. This stack exhausts filtered air from the 1706-KE Laboratory. Emission monitoring consists of a record sampler.

- **1706-KER**. This stack exhausts filtered air from the basement area (approximately 8.2 m [27 feet] below grade) of the 1706-KE Laboratory. Emission monitoring consists of a record sampler.

A.3 200 EAST AREA FACILITIES

The 200 East Area contains facilities for chemical separations, processing, and waste handling and disposal. The radionuclide air emission discharge points in the 200 East Area are shown in Figure 1-4. The PUREX Plant and related tank farm and evaporator facilities discharge volatile forms of radionuclides, specifically ^{3}H, ^{106}Ru, ^{125}Sb, and ^{129}I. When operating, the PUREX Plant discharged ^{85}Kr, but it has not operated fully since

December 1989. No activities conducted in the 200 Areas in 1996 resulted in a discharge of ^{85}Kr.

A.3.1 PUREX Plant

The PUREX Plant is a nuclear-fuel reprocessing plant constructed in 1956 and operated until 1972, when it was placed on standby status until November of 1983. In November of 1983 the PUREX Plant resumed operations, processing a backlog of irradiated fuel from N Reactor. The plant was again placed in standby following a stabilization run that ended in March 1990. Shutdown orders were issued to PUREX in December 1992, and as a result, the plant has been deactivated. During 1996, deactivation efforts rerouted the ventilation of most of PUREX's stacks, such that their emissions are discharged through the 291-A-1 stack. As a result of this effort, many of PUREX's stacks were shutdown and deactivated during 1996.

- **291-A-1**. This stack exhausts filtered air from canyon ventilation (Cells A to M), and vessel and condenser vents. Emission monitoring consists of a record sampler and a silver zeolite cartridge.

- **296-A-1**. This stack exhausts filtered air from N and Q Cells, Product Removal rooms, and gloveboxes in these rooms. Emission monitoring consists of a record sampler and an alpha CAM. This stack was permanently shutdown on 10/25/96 and deactivation was completed on 11/21/96.

- **296-A-2**. This stack exhausts filtered air from the west sample gallery hoods. Emission monitoring consists of a record sampler. This stack was permanently shutdown on 12/13/96 and deactivation was completed on 1/08/97.

- **296-A-3**. This stack exhausts filtered air from hoods in the east sample gallery. Emission monitoring consists of a record sampler. This stack was permanently shutdown on 2/15/96 and deactivation was completed on 1/09/97.

- **296-A-5A and 296-A-5B**. These stacks exhaust filtered air from laboratory hoods. Emission monitoring for each stack consists of a record sampler. These stacks were permanently shutdown on 7/29/96 and deactivation was completed on 1/16/97.

- **296-A-6**. This stack exhausts filtered room air from the east sample gallery and U Cell. Emission monitoring consists of a record sampler. This stack was permanently shutdown on 12/12/96 and deactivation was completed on 1/08/97.

- **296-A-7**. This stack exhausts filtered room air from the PUREX west sample gallery and R Cell. Emission monitoring consists of a record sampler. This stack was permanently shutdown on 11/25/96 and deactivation was completed on 1/08/97.

- **296-A-8**. This stack exhausts filtered air from the PUREX Plant Pipe and Operating gallery and the White Room. Emission monitoring consists of a record sampler. This stack was permanently shutdown on 12/31/96 and deactivation was completed on 1/06/97.

- **296-A-10**. This stack exhausts filtered air from storage tunnel No. 2. Emission monitoring consists of a record sampler. This stack was permanently shutdown on 12/23/96 and deactivation was completed on 2/26/97.

- **296-A-14**. This stack exhausts filtered air from the 293-A Off-gas Treatment and Recovery Building (for nitric acid recovery). Emission monitoring consists of a record sampler. This stack was permanently shutdown on 11/18/96 and deactivation was completed on 12/06/96.

- **296-A-24**. This stack exhausts filtered air from E and F Cell vessels to reduce the ammonium nitrate loading on the 291-A-1 filters. Emission monitoring consists of a record sampler. This stack has been inactive since March of 1990. Deactivation was completed on 9/03/96.

A.3.3 B Plant and Waste Encapsulation Storage Facility

This facility contains two major operating system areas, B Plant and the Waste Encapsulation Storage Facility (WESF). B Plant was designed and used to separate plutonium from spent nuclear fuel. More recently B Plant was reconfigured to remove ^{137}Cs and ^{90}Sr from high-level liquid waste. At WESF, the ^{137}Cs and ^{90}Sr were converted to solid strontium fluoride and cesium chloride, doubly encapsulated, and placed in water-filled storage basins. WESF is used to store the radioactive strontium and cesium capsules. The 221-B Building contains radioactive contamination remaining from previous production campaigns that must be properly managed.

- **291-B-1**. This is the B Plant main stack, which exhausts filtered air from the main canyon and process cells in the 221-B Building, from the process cell in the 212-B Building, and the 224-B Building. Emission monitoring consists of a record sampler, a backup record sampler, and a beta-gamma CAM.

- **296-B-5**. This stack exhausts filtered air from the 221-BB Building, which houses the B Plant process condensate and B Plant steam condensate receiver tanks. Emission monitoring consists of a record sampler and a beta-gamma CAM.

- **296-B-10**. This stack exhausts filtered air from the 225-B Building, which is also known as WESF. Emission monitoring consists of a record sampler and a beta-gamma CAM.

- **296-B-13.** This stack exhausts filtered air from the 221-BF Condensate Effluent Discharge Facility, which houses process condensate retention tanks. Emission monitoring consists of a record sampler and a beta-gamma CAM.

A.3.4 AR and CR Vaults

The AR and CR Vaults are retention and treatment facilities for high-level radioactive liquid wastes.

- **296-A-12.** This stack exhausts filtered air from the 244-AR Vault vessel ventilation system. Emission monitoring consists of a record sampler and a beta-gamma CAM. This stack did not operate in 1996.

- **296-A-13.** This stack exhausts filtered air from the 244-AR Vault canyon and cells. Emission monitoring consists of a record sampler and a beta-gamma CAM. This stack did not operate in 1996.

- **296-C-5.** This stack exhausts filtered air from the 244-CR Vault Cell and vessel ventilation. Emission monitoring consists of a record sampler and a beta-gamma CAM.

A.3.5 200 East Area Tank Farms (excluding the Evaporator)

Radioactive waste stored in tank farms consists of sludge and saltcake in single-shell tanks (SSTs) and slurry in double-shell tanks (DSTs).

- **296-A-17 and 296-P-26.** These stacks exhaust filtered, incondensable vapors from waste storage tanks in the 241-AY and -AZ Tank Farms. Emission monitoring for each stack consists of a record sampler, two silver-zeolite cartridge samplers for volatile radionuclides, and a beta-gamma CAM. The 296-P-26 stack serves as the backup exhauster for the 296-A-17 stack.

- **296-A-18.** This stack exhausts filtered air from the 241-AY-101 tank annulus. Emission monitoring consists of a record sampler. This stack operated for 1.1 hours in 1996 and was not sampled, since a representative sample could not be obtained within 2.1 hours.

- **296-A-19.** When this stack was operational, filtered air was released through it from the 241-AY-102 tank annulus. Emission monitoring consisted of a record sampler. This stack operated for 2.1 hours in 1996 and was not sampled, since a representative sample could not be obtained within 1.1 hours.

- **296-A-20.** 241-AZ Tank Annuli Exhaust. This stack exhausts filtered air from the 241-AZ-101 and -102 tank annuli. Emission monitoring consists of a record sampler.

- **296-A-25**. This stack exhausts filtered air from the catch tank at the 244-A lift station. Emission monitoring consists of a record sampler and a beta-gamma CAM.

- **296-A-26**. This stack exhausts filtered air from the waste unloading room and sump tank at the 204-AR tank. Emission monitoring consists of a record sampler and a beta-gamma CAM.

- **296-A-27**. This stack exhausts filtered air from all 241-AW tanks. Emission monitoring consists of a record sampler, two silver-zeolite cartridge samplers for volatile radionuclides, and a beta-gamma CAM.

- **296-A-28**. This stack exhausts filtered air from all tank annuli in the 241-AW tank farm. Emission monitoring consists of a record sampler and a beta-gamma CAM.

- **296-A-29**. This stack exhausts filtered air from all 241-AN tanks. Emission monitoring consists of a record sampler and a beta-gamma CAM.

- **296-A-30**. This stack exhausts filtered air from all tank annuli in the 241-AN tank farm. Emission monitoring consists of a record sampler and a beta-gamma CAM.

- **296-A-40**. This stack exhausts filtered air from all 241-AP tanks. Emission monitoring consists of a record sampler, two silver-zeolite cartridge samplers for volatile radionuclides, and a beta-gamma CAM.

- **296-A-41**. This stack exhausts filtered air from all tank annuli in the 241-AP tank farm. Emission monitoring consists of a record sampler and a beta-gamma CAM.

- **296-B-28**. This stack exhausts filtered air from the 244-BX saltwell receiver tank and annulus. Emission monitoring consists of a record sampler and a beta-gamma CAM.

- **296-P-16**. This stack exhausts filtered air from Tanks 241-C-105 and 241-C-106. Tank 241-C-104 is also vented by this stack as it is connected to tank 241-C-105 with an underground cascade line. Emission monitoring consists of a record sampler and a beta-gamma CAM.

- **296-P-17**. This stack used to exhaust filtered air from Tank 241-A-105; and tanks 241-A-104 and 241-A-106 which are connected to tank 241-A-105 with underground cascade lines. Emission monitoring consists of a record sampler and a beta-gamma CAM. This stack did not operate in 1996. These tanks now are passively vented through breather filters and a Report of Closure request for this stack has been submitted to the Washington State Department of Health in accordance with WAC 246-247-080(6).

- **296-P-32, 296-P-33, and 296-P-34**. These emission points are the portable exhausters for the Rotary Mode Core Samplers. These emission sources exhaust filtered air from the waste tanks being core sampled. Emissions monitoring consists of a record sampler, a beta-gamma CAM, and an alpha CAM. These stacks did not operate in 1996.

A.3.6 200 East Area Evaporator

The evaporator processed liquid waste in 1996. The evaporator is used to remove most of the water from high-level radioactive liquid waste, leaving a slurry that is pumped back to tank farms.

- **296-A-21**. This stack exhausts filtered air from the 242-A Evaporator-Crystallizer Building. Emission monitoring consists of a record sampler, an alpha CAM, and a beta-gamma CAM.

- **296-A-22**. This stack exhausts filtered air from the 242-A Evaporator-Crystallizer vessel-ventilation system. Emission monitoring consists of a record sampler and a silver-zeolite cartridge sampler for volatile radionuclides, an alpha CAM, and a beta-gamma CAM.

A.3.7 Effluent Treatment Facility (ETF)

This facility treats radioactive liquid effluents prior to their disposal at the 616-A crib.

- **296-E-1**. When this stack operates air is exhausted from the ETF. Emission monitoring consists of a record sampler.

A.3.7 Grout Treatment Facility

This facility solidified low-level waste for disposal in underground vaults. The facility was placed in cold standby in 1993.

- **296-G-1**. When this stack operates air is exhausted from the GTF Air Filtration Module. Emission monitoring consists of a record sampler and a beta-gamma CAM. This stack did not operate in 1996.

A.3.8 209-E Critical Mass Laboratory

The Building was originally designed and used for testing critical mass configurations. Currently the building is being used for office space.

- **296-P-31 (formerly 209-E)**. This stack exhausts filtered building ventilation air. The particulate alpha and beta radioactivity emissions, from the building exhaust, are sampled with a record sampler.

A.4 200 WEST AREA FACILITIES

The 200 West Area contains facilities for chemical separations, processing, and waste handling and disposal. The radionuclide air emission discharge points in the 200 West Area are shown in Figure 1-5.

A.4.1 S Plant

S Plant is another name for the Reduction-Oxidation Plant (REDOX), which is the 202-S building. The REDOX Plant was operated as a fuel-reprocessing facility until 1967 when it was shut down.

- **291-S-1**. The REDOX main stack exhausts filtered air from the REDOX canyon, vessel ventilation, and treated dissolver off-gas system. Emission monitoring consists of a record sampler and a beta-gamma CAM.

- **296-S-2**. This stack exhausts filtered air from REDOX north and south sample galleries, hoods, and product removal cage. Emission monitoring consists of a record sampler.

- **296-S-4**. This stack exhausted filtered air from the REDOX decontamination room and regulated shop and unfiltered air from the regulated tool room, low-level decontamination sink, and special work permit lobby. Emission monitoring consisted of a record sampler. This emission unit did not operate in 1996 and was deactivated (e.g. blanked off) on October 4, 1996.

- **296-S-6**. This stack exhausted air from the REDOX Plant, the silo gallery, an organic feed tank, and a sample elevator. Emission monitoring consisted of a record sampler. This emission unit did not operate in 1996 and was deactivated on September 18, 1996.

- **296-S-7W and 296-S-7E**. These stacks exhaust filtered air from the 233-S REDOX Product building, the REDOX plutonium-processing greenhouse, and process vessel ventilation and load-out area. Emission monitoring for each stack consists of a record sampler and an alpha CAM. The 296-S-7E stack serves as the backup exhauster for the 296-S-7W.

A.4.2 T Plant

T Plant is one of the original fuel reprocessing facilities. The last fuel reprocessed there was in 1956. The 221-T Building is currently used to treat, store, repackage, sample, and verify wastes. The 221-T Building also is used for decontaminating and repairing equipment.

- **291-T-1**. This stack exhausts filtered air from 221-T canyon and process ventilation. Emission monitoring consists of a record sampler, a beta-gamma CAM, and an alpha CAM.

- **296-T-13**. This stack exhausts filtered air from the 221-T Building and canyon ventilation. Emission monitoring consists of a record sampler and a beta-gamma CAM.

- **296-T-7**. This stack exhausts filtered air from the 2706 Building only while decontamination activities are being performed, the remaining times it is turned off. Emission monitoring consists of a record sampler and beta-gamma CAM.

A.4.3 TRUSAF

The 224-T Building was originally used to purify plutonium nitrate by the lanthanum fluoride process. After phase-out of the bismuth phosphate plants, the lanthanum fluoride process was no longer needed and the facility remained inactive until the early 1970's. At that time, the 224-T Building was modified for storage of plutonium scrap in liquid and solid forms. In 1984 the facility was selected to house the transuranic waste storage and assay (TRUSAF) operation. The TRUSAF operation involves the analysis of transuranic waste to verify compliance with the Waste Isolation Pilot Plant (WIPP) waste acceptance criteria. Those containers meeting WIPP acceptance criteria are stored at 224-T pending shipment to the WIPP.

- **296-T-11**. This stack exhausts filtered air from the 224-T Building ventilation through the east part of the plenum. Emission monitoring consists of a record sampler.

- **296-T-12**. This stack exhausts filtered air from the 224-T Building ventilation through the west part of the plenum. Emission monitoring consists of a record sampler.

A.4.4 U Plant

U Plant was constructed as a fuel reprocessing plant but was never used for that purpose. Instead, it was used to recover uranium from bismuth-phosphate waste and high-level radioactive wastes from tank farms. Currently, it is a retired facility with a few offices and shops still in use.

- **291-U-1**. This stack exhausts filtered air from U Plant and 221-U canyon ventilation. Emission monitoring consists of a record sampler and a beta-gamma CAM.

A.4.5 Uranium-TriOxide Plant (UO_3 Plant)

Located in the 200 Area is the Uranium-TriOxide (UO_3) Plant, which formerly produced uranium trioxide from PUREX Plant solutions. In 1972 the UO_3 Plant was shut down. Later, it was refurbished to process uranyl nitrate hexahydrate from the PUREX Plant, and was restarted in March 1984. The UO_3 Plant operated for the final time in June 1993 processing uranyl nitrate hexahydrate into the more stable compound of uranium trioxide. The plant was deactivated immediately after its final run, in 1993. In December 1994 the facility was transferred from WHC to BHI. UO_3 no longer has any point source air emissions, all UO_3 stacks were blanked off in late 1994.

A.4.6 Plutonium Finishing Plant (PFP)

PFP was constructed to produce plutonium metal from recovered nitrate and plutonium nitrate received from the PUREX Plant. PFP also recovered plutonium, in the form of plutonium nitrate, from plutonium scrap. PFP's current mission is to stabilize and store existing inventory of plutonium compounds.

- **291-Z-1**. This stack exhausts filtered air from the 234-5Z, 236-Z, and 242-Z Buildings. Emission monitoring consists of a record sampler and an alpha CAM.

- **296-Z-3**. This stack exhausts filtered air from 241-Z vault sump and vessel ventilation. Emission monitoring consists of a record sampler and an alpha CAM.

- **296-Z-5**. This stack exhausts filtered air from 2736-ZB, the shipping and receiving building. Emission monitoring consists of a record sampler and an alpha CAM.

- **296-Z-6**. This stack exhausts filtered air from the 2736-Z Building and its plutonium storage vault ventilation system. Emission monitoring consists of a record sampler and two alpha CAMs. One alpha CAM is located on each of the two ducts feeding into this stack.

- **296-Z-14**. This stack exhausts filtered air from the 232-Z Incinerator Building. Emission monitoring consists of a record sampler and two alpha CAMs.

- **296-Z-15**. This stack exhausts filtered air from the 243-Z Low Level Waste Treatment Facility. Emissions monitoring consists of a record sampler.

A.4.7 200 West Area Tank Farms (Excluding Evaporators)

Radioactive waste stored in tank farms consists of sludge and saltcake in SSTs and liquid and slurry in DSTs.

- **296-P-22**. This stack exhausts filtered air from annuli in the 241-SY-101, -102, and -103 tanks. Emission monitoring consists of a record sampler and a beta-gamma CAM.

- **296-P-23 (296-P-28 backup stack)**. This stack exhausts filtered air from the 241-SY-101, -102, and -103 tanks. Emission monitoring consists of a record sampler and a beta-gamma CAM.

- **296-S-15**. This stack exhausts filtered air from tanks 241-SX-107 through -112 and 241-SX-114. Emission monitoring consists of a record sampler and a beta-gamma CAM.

- **296-S-22**. This stack exhausts filtered air from the 244-S saltwell receiver tank and annulus. Emission monitoring consists of a record sampler, an alpha CAM, and a beta-gamma CAM.

- **296-T-18**. This stack exhausts filtered air from the 244-TX saltwell receiver tank and annulus. Emission monitoring consists of a record sampler, an alpha CAM, and a beta-gamma CAM.

A.4.8 200 West Area Evaporators

The evaporators are designed to remove most of the water from radioactive liquid waste; the resulting slurry is then routed to tank farms for storage. The 242-T Evaporator-Crystallizer has been deactivated and has been inoperable since 1986. The 242-S Evaporator-Crystallizer did not operate in 1996, but is on standby.

- **296-S-18**. This stack exhausts filtered air from the 242-S Evaporator-Crystallizer Building. Emission monitoring consists of a record sampler and a beta-gamma CAM.

- **296-T-17**. This stack exhausts filtered air from the 242-T Evaporator-Crystallizer and cold-cell ventilation. Emission monitoring consists of a record sampler, an alpha CAM, and a beta-gamma CAM.

A.4.9 222-S Analytical Laboratories

The 222-S Analytical Laboratories provide chemical and radiochemical analytical support for tank farm waste characterization, research and development, and environmental sample analysis.

- **296-S-16**. This stack exhausts filtered air from the 219-S Building and waste tanks. Emission monitoring consists of a record sampler.

- **296-S-21**. This stack exhausts filtered air from 222-S Laboratory hoods, gloveboxes, hot-cells, and room ventilation system. Emission monitoring consists of a record sampler, an alpha CAM, and a beta-gamma CAM.

A.4.10 Waste Sampling and Characterization Facility (WSCF)

The WSCF laboratory provides low-level radiological and chemical analyses on various types of samples and sample medias. The majority of the analyzed samples are used to determine compliance with the requirements of environmental regulations and U.S. Department of Energy (DOE) Orders. Note that WSCF is technically located in the 600 Area, and is immediately outside of the 200 West Area's perimeter. It is included in the section for the 200 West Area, since its releases are modelled from the 200 West Area.

- **696-W-1**. This stack exhausts filtered air from the analytical laboratory located on the main floor of the 6266 building. Emission monitoring consists of a record air sampler.

- **696-W-2**. This stack exhausts filtered air from the Nuclear Spectroscopy Laboratory located in the basement of the 6266 building. Emission monitoring consists of a record sampler.

A.4.11 Waste Verification & Sampling Facility

The facility is used to verify the contents of drums received from generators. Because of limited use, it was transferred to West Tank Farms in 1995.

- **296-W-3**. This exhaust discharges filtered air from the 213-W building. Emission monitoring consists of a record sampler and a beta-gamma CAM.

A.5 300 AREA FACILITIES

The 300 Area consists primarily of laboratories, research facilities, and a steam plant. Emission points in the 300 Area are shown in Figure 1-6.

A.5.1 306-E Metal Fabrication Development Building

This building is in use for materials testing and fabrication. In the past, this building housed three separate operations; (1) a large, high-bay used for unfueled test article fabrication for FFTF, (2) nondestructive, radiography examination in a series of shielded cells, and (3) a small depleted-uranium-powder laboratory used to fabricate insulator pellets for the FFTF fuel pins. In August 1995, this facility was shutdown and has since been stabilized, changing its radiological status to a fixed contamination area.

- **306-E-ULAB**. This stack exhausts filtered air from the Uranium Oxide Laboratories in rooms 158 and 159, which no longer contains loose contamination. Emission monitoring consists of a record sampler. This emission unit was deactivated in August 1995.

A.5.2 308 Fuels Development Laboratory

The 308 Laboratory was used for fabricating mixed-oxide fuel pins used by FFTF. The facility houses a shutdown swimming-pool-type Test Reactor and Isotope Production reactor by General Atomics (TRIGA) that was used in neutron radiography of the completed pins. The 308 Building is in transition to shutdown.

- **308-TRIGA**. This stack discharges filtered air from the reactor hall housing the TRIGA reactor. The reactor, however, is permanently shut down and partially defueled. Emission monitoring consists of a particulate record sampler. This emission point was shut down on April 2, 1996 and was deactivated in 1996.

A.5.3 309 Plutonium Recycle Test Reactor

The 309 Building's containment dome and support facilities once housed the Plutonium Recycle Test Reactor (PRTR). In 1962, the Plutonium Recycle Critical Facility (PRCF) was added to support the PRTR operations. By 1975, the PRTR was deactivated, all of the fuel removed from the building, and the fuel storage basin decontaminated. In the mid 1980's, an extensive clean out effort removed most of the process equipment and vessels. The ground level of the containment dome is currently being used an assembly shop and the remainder of the building is used as office space.

- **309-PRTR**. The 309 Building's primary stack ventilates what used to be the PRTR facility. Periodic confirmatory measurements are used to confirm that emissions are at or below acceptable levels.

- **309-RTF-EX**. 309 Building rupture loop annex exhaust stack. Periodic confirmatory measurements are used to confirm that emissions are at or below acceptable levels.

A.5.4 340 Complex

The 340 Complex houses the radioactive liquid waste and solid waste handling operations for the 300 Area. The 340-A Building contains six aboveground storage tanks for radioactive liquid waste. The east side of the 340-B building is a railway car load out facility for shipping liquid waste to the 200 Areas. The west side of the 340-B building is a storage area for non-radioactive and radioactive solid waste.

- **340-NT-EX.** This stack exhausts filtered air from the 340 Building vault, the 340 Building vault tanks, and the 340-A Building waste tanks. Emission monitoring consists of a particulate record sampler, a beta-gamma CAM, and a record sampler for volatile ^{131}I.

- **340-B-BLDG.** This stack exhausts filtered air from the 340-B East Building. The stack exhaust system operates when railway cars are housed within the facility. Emissions monitoring consists of a particulate record sampler.

- **340-DECON.** This stack exhausts air from the 340 Facility truck lock, operator's office, change rooms, decontamination area, and sampling hood. Emissions monitoring consist of a particulate record sampler.

A.5.5 324 Waste Technology Engineering Laboratory

The building contains laboratories for performing chemical and process development activities. The landlord responsibilities for the 324 building were transferred from PNNL to FDH on November 1, 1996.

- **EP-324-01-S.** This stack exhausts filtered building air. The exhaust is sampled for particulate radioactivity (total alpha, total beta, ^{90}Sr, ^{238}Pu, $^{239,240}Pu$, ^{241}Am, and gamma emitting radionuclides) and tritium (HTO and HT).

A.5.6 327 Post Irradiation Testing Laboratory

The building contains hot-cells for examining and testing irradiated materials. The landlord responsibilities for the 327 building were transferred from PNNL to FDH on November 1, 1996.

- **EP-327-01-S.** This stack exhausts filtered building air. The exhaust is sampled for particulate radioactivity (total alpha, total beta, ^{90}Sr, ^{238}Pu, $^{239,240}Pu$, ^{241}Am, gamma emitting radionuclides), gaseous radon (^{220}Rn and ^{222}Rn), and tritium (HTO and HT).

- **EP-327-02-V.** This roof vent exhausts filtered air from the decontamination cell. The exhaust is sampled for particulate radioactivity (total alpha, total beta, ^{90}Sr, ^{238}Pu, $^{239,240}Pu$, ^{241}Am, and gamma emitting radionuclides).

A.5.7 377 Geotechnical Engineering Laboratory

This facility was formerly known as the 377 Steam Generator Examination Facility. In 1993 the facility was renamed the 377 Geotechnical Engineering Laboratory to reflect the change in operations. The stack name was also changed from 377-SGEF to 377-GEL. The facility was formerly used for studying a steam generator that had been removed from a nuclear power plant. The steam generator was removed before 1990 and the facility was decontaminated. In 1991 and 1992, the facility was modified for use as a physical properties testing laboratory for radioactively contaminated soils and began laboratory operation in 1993.

- **377-GEL**. This stack exhausted filtered building ventilation air. The exhaust was sampled for particulate alpha and beta radioactivity. This emission point was shut down on January 1, 1996 and deactivated in 1996.

A.6 400 AREA FACILITIES

The 400 Area consists of the FFTF, the Maintenance and Storage Facility (MASF), and the Fuels Materials Examination Facility. Emission points in the 400 Area are shown in Figure 1-7.

A.6.1 Fast Flux Test Facility

FFTF, located in the 400 Area, is a 400-megawatt thermal, sodium-cooled, low-pressure, high-temperature reactor plant. It was used for irradiation testing of breeder reactor fuels and materials.

- **FFTF-RE-SB**. Lower Reactor Service Building (RSB). This exhaust discharges unfiltered air from the lower level of the RSB. Emission monitoring consists of a particulate record sampler, a beta CAM, a noble gas monitor, and a record sampler for volatile ^{131}I.

- **FFTF-CB-EX**. Combined exhaust. This stack exhausts normally unfiltered air from the reactor containment and gases from the argon processing system. Standby particulate filters are automatically dampered into the system if airborne radioactive particulate concentrations exceed administrative limits. Emission monitoring consists of an particulate record sampler, a beta CAM, a noble gas monitor, a tritium (HTO) record sampler, and a record sampler for volatile ^{131}I.

- **FFTF-HT-TR**. Heat Transport System South. This exhaust discharges normally unfiltered air from portions of FFTF that are exterior to the containment. Standby particulate filters are automatically dampered into the system if airborne radioactive particulate concentrations exceed administrative limits. Emission monitoring consists of a record sampler, a beta CAM, and a noble gas monitor.

A.6.2 437 MASF

The Maintenance and Storage Facility (MASF) is a multipurpose service center supporting the specialized maintenance and storage requirements of FFTF. The MASF provides the capability for sodium film removal, decontamination, repair, and storage of nonfueled components and hardware for FFTF.

- **437-MN&ST**. This exhaust discharges filtered air from the MASF. Emission monitoring consists of a record sampler and a beta CAM.

- **437-1-61**. This exhaust discharges filtered air from the MASF. Emission monitoring consists of a record sampler and a beta CAM.

APPENDIX B

MONITORING PROGRAM FOR RADIOACTIVE AIR EMISSIONS AND LIQUID EFFLUENTS

APPENDIX B

MONITORING PROGRAM FOR RADIOACTIVE AIR EMISSIONS AND LIQUID EFFLUENTS

The monitoring program for air emissions and liquid effluents comprises several activities designed to obtain and report high-quality sampling and analysis data to determine compliance with U.S. Department of Energy guidelines and federal, state, and local regulations.

B.1 AIR EMISSION SAMPLE COLLECTION AND ANALYSIS

A representative sample of air emissions during the collection period is obtained by extracting the sample at a velocity that is as close as practicable to the stack airflow velocity and by holding the ratio of sample volume to total stack discharge volume constant within $\pm 20\%$.

The following methods are generally used to sample air emissions.

- **Record Sampler**. A stack record sampler collects radioactive emissions on a collection media, usually a particle filter, that is exchanged and evaluated as specified by WMH Air and Water Services. Particulate record samples are analyzed by the receiving laboratory for total alpha and total beta activity. Record samplers provide an indication of the amounts and concentrations of airborne radioactive material being discharged to the environment. Collection media for record samplers may vary, and is dependent on the radionuclide and chemical form of the substance being sampled. Record samplers do not utilize detectors, strip charts, or alarms.

- **Continuous Air Monitor.** Continuous air monitors (CAMs) serve as warning devices to alert personnel to air emission releases exceeding normal operating parameters. A CAM collects particles on a filter monitored continuously by a radiation detector. The CAM filter may also be used as a backup for the record sample if necessary.

The following are the sample collection media utilized for collecting record samples.

- **Particle Filters.** Particle filters are the most common collection media used at Hanford to collect radioactive airborne particles. Filter medias for routine samples usually consist of either a membrane filter or glass fiber filter.

- **Silver-Zeolite or Charcoal Cartridges**. Silver-zeolite or charcoal cartridges are used to collect iodine and volatile forms of antimony, ruthenium, and tin.

- **Silica-Gel**. Silica-gel columns are used to collect tritium (^3H).

- **Grab Air Samples**. Grab air samples are used to collect samples of noble gases (e.g. Argon-41). A known volume of gas is collected with a sampler and then usually analyzed using a gamma-ray detector.

The PUREX and PFP facilities routinely report Plutonium-241 emissions. These emissions are calculated from facility inventories, since it can not be readily sampled and analyzed using conventional methods.

B.2 LIQUID EFFLUENT SAMPLE COLLECTION AND ANALYSIS

Liquid effluent sample collection schemes are designed to provide a representative sample of the effluent. Volume proportionality and extraction from a well-mixed stream are accomplished where practicable. Liquid effluent streams are sampled using the following: (1) weekly grab sampling, (2) batch sampling for a retention area, (3) incremental time-proportional sampling, (4) incremental flow-proportional sampling, and (5) continuous flow-proportional sampling.

Samples of the liquid effluent are collected for one month, composited, and then analyzed for total alpha and total beta activity. Specific radionuclide analyses are also performed on liquid effluent streams with a potential to exceed predetermined limits or as specified by WMH Air & Water Services.

B.3 DATA HANDLING

Radionuclide air and liquid effluent data received, are as follows:

- Stack record air sampler flowrates, total flow volume, and sample times.
- Stack flow rates determined via 40 CFR 60 Appendix A Methods 2 and 2A or employing mass flowmeters on the stack, or an approved alternate method.
- Liquid discharge volumes.
- Sample analysis data.

These data are reviewed continually for consistency and errors. Concentration values calculated weekly, monthly, and quarterly are compared with past and present facility releases and with environmental release guides. All anomalies are investigated.

Generally, total alpha and total beta analysis results do not accurately reflect specific radionuclide emissions. However, if alpha results indicate a release concentration much less than the most restrictive limit for a specific alpha emitting radionuclide, the discharge is assumed to be within the release limits for all alpha emitters. The same methodology is employed for beta emitters. Exceptions to this methodology do exist. In liquids, results for total beta do not include ^{3}H, a low-energy beta emitter, and volatile alpha and beta emitters that may be driven off with evaporation (e.g., ^{129}I and ^{210}Po). Radioactive gases and volatile radionuclides are not included in total alpha and beta analyses of air samples. Separate analyses are performed for ^{3}H, volatile substances, and gases when appropriate.

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